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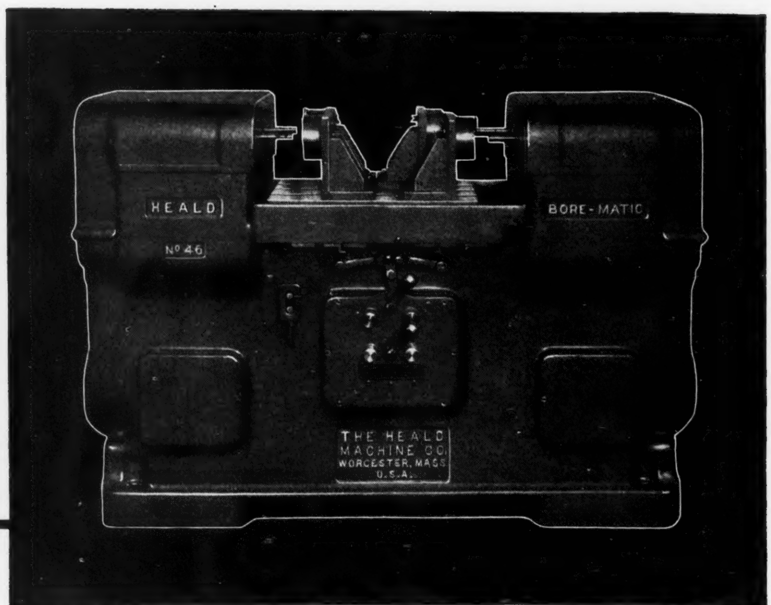

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MACHINERY

Volume 37 NEW YORK, JUNE, 1931 Number 10

Watching Stresses at Work

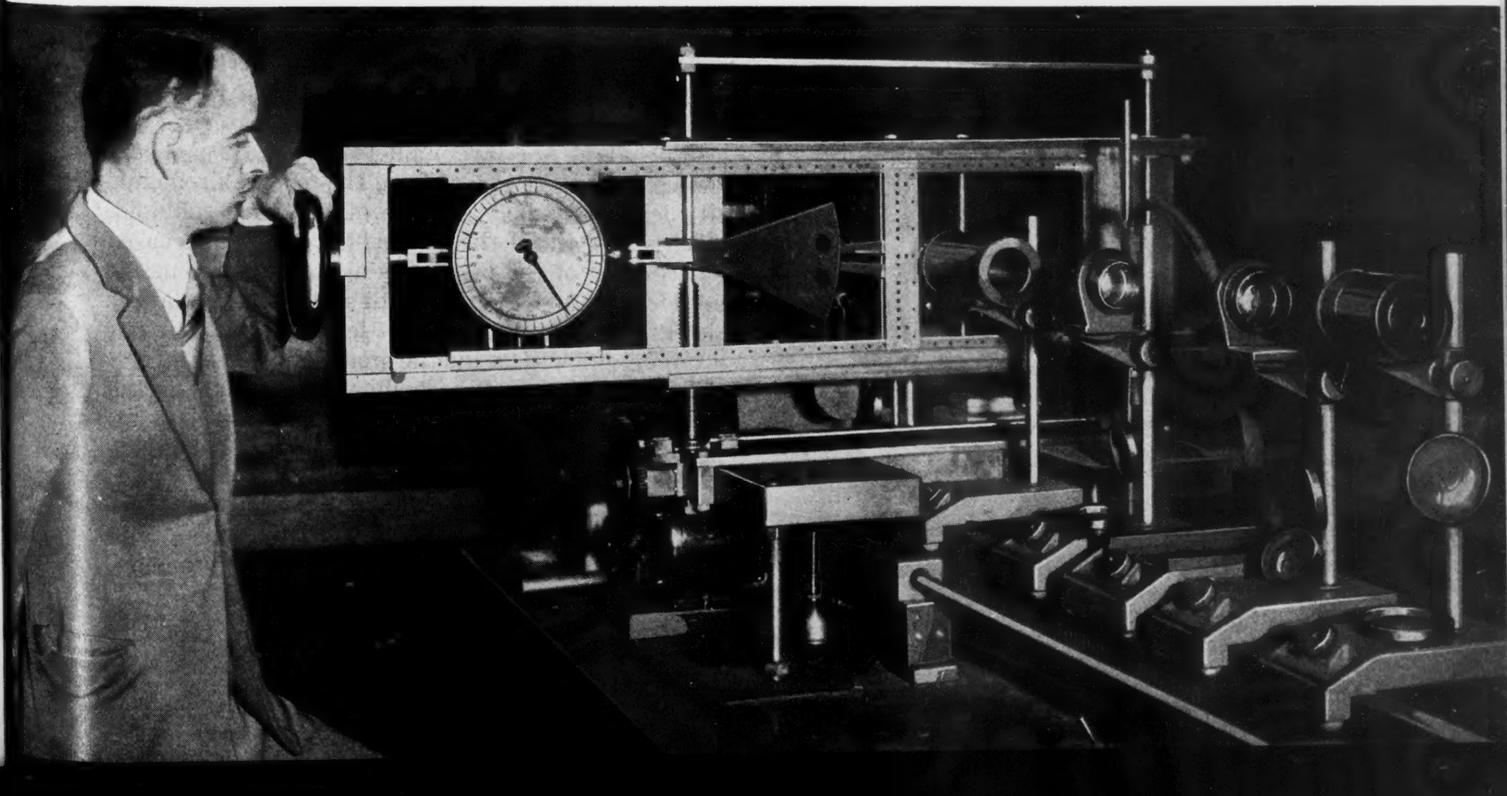
By HENDLEY N. BLACKMON
General Engineer, Westinghouse Electric & Mfg. Co.

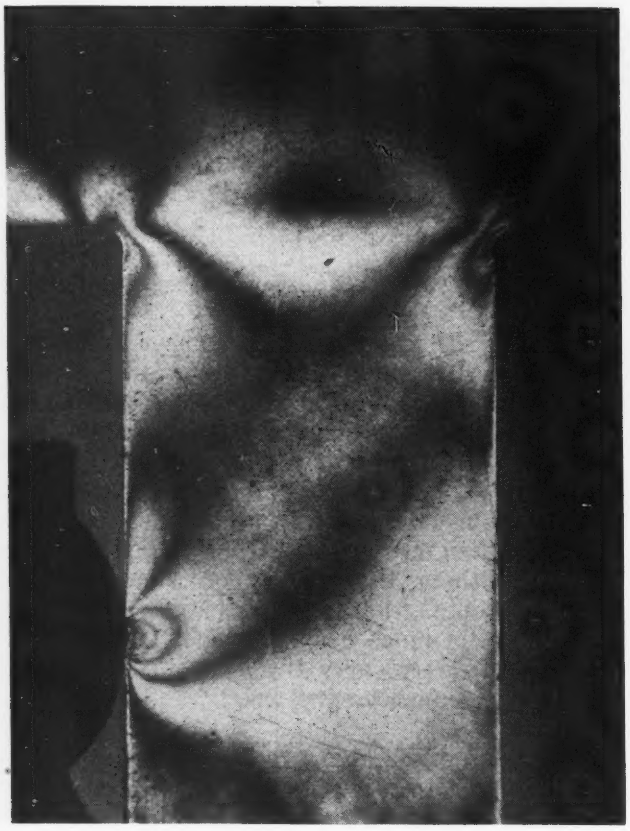
The photo-elastic method of examining stresses simplifies the problems of the machine designer by showing the direction and intensity of stresses in loaded parts

ENGINEERS often have difficulty in determining the strength of machine members or other structures that are of such design that a satisfactory calculation cannot be made by the use of mathematical formulas. When such a problem arises, the designer's only safe course is to so proportion the member that, in accordance with good designing judgment, it is strong enough for the purpose without the shadow of a doubt. This means, of course, that in most cases, the new member is made of much heavier proportions than are required to safely carry the loads to be imposed. The result is unnecessary weight and a waste of materials.

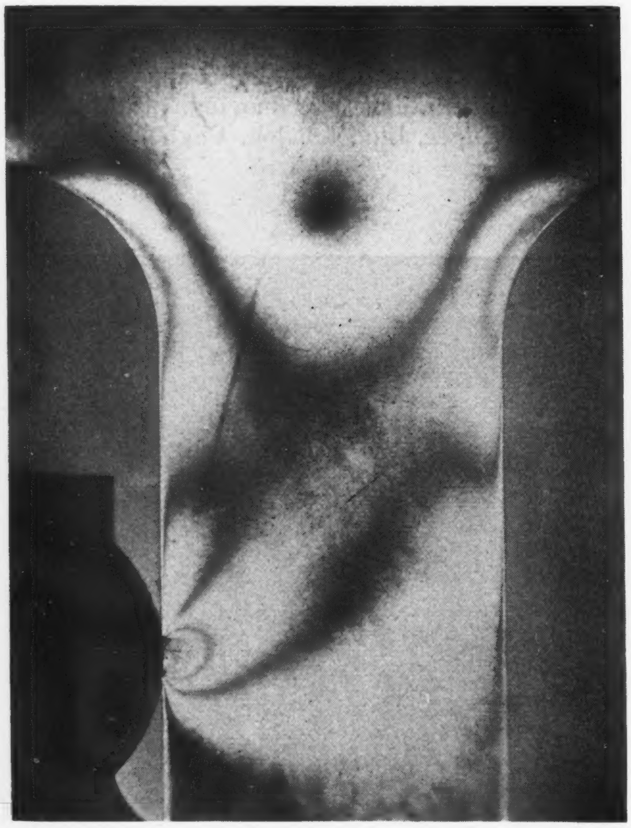
Problems of this kind are readily solved at the Westinghouse Research Laboratories by means of a so-called "photo-elastic" apparatus, which shows, by different colors on a screen, the magnitude and location of stresses in models of the parts being investigated. These models are made from transparent materials. Loads are applied to the models in the same manner as in actual service.

Stress distribution does not depend upon the material, as long as the elastic limit is not exceeded, and so results obtained with the models apply directly to steel and other materials. This photo-elastic apparatus has provided a practical method of studying stresses in both simple and complicated parts, either stationary or moving. It was made by Adam Hilger, Ltd., London, England.





Figs. 1 and 2. Images of Photo-elastic Models Loaded to Show the Different Stress Distribution as a Result of Using Large and Small Fillets



Details Concerning the Photo-Elastic Apparatus

The photo-elastic apparatus consists essentially of a lantern for producing white light, an optical system for polarizing the light, and an 18-inch square screen on which images of stressed models are projected. Based on well-known optical phenomena, bands of color will appear on the image as a model is stressed. These colors range from black through orange and red to green. Black indicates the absence of stress, and green the greatest amount. The color bands repeat themselves if the load continues to increase. In the accompanying illustrations of such images, the stress bands, of course, appear black and white, and so numbers are given to indicate the intensity of the stresses. The higher the number, the greater the stress.

The transparent models must be isotropic, that is, they must be made of a material possessing the same physical properties in all directions, so that when the models are unburdened, light will be transferred with equal ease in all directions. Celluloid, Bakelite, and glass about 1/4 inch thick are all satisfactory. Glass is often ideal, but it is seldom used industrially because of the expense in shaping it.

Celluloid is generally used in the Westinghouse Research Laboratories. Since the elastic limit of steel is much higher than that of celluloid, the load on the model is correspondingly less. Stresses in two directions are solved easily, and special models have shown stresses in three directions.

How Large Fillets Strengthen Parts

Almost any machine is an assembly of structural elements having fillets, notches, and holes. Many such parts, which defy accurate analytical solution, have been carefully investigated photo-elastically to determine the stress distribution and where the stresses are most dangerous. For example, a study was made of two test models of clear Bakelite, which were exactly the same except for the radius of their fillets. Photographs taken of these models when stressed are reproduced in Figs. 1 and 2. Attention is called to the even lines of stress in the model shown in Fig. 2, which has fillets of large radius, as compared with the peaked stresses produced opposite the fillets in the model in Fig. 1.

With the models made from brittle materials, the design having the larger fillets proved 52 per cent stronger than the other. Then the test was repeated with less rigid models made of camphor celluloid, which showed that the larger fillet radius increased the strength of the piece only about 10 per cent. It is evident, therefore, that with static loads, a larger fillet greatly strengthens brittle parts, but it is not so important with a ductile material.

The illustration Fig. 3 shows a pattern of the stresses that occur in a notched bar as it is bent. From the numbers, it will be obvious that the greatest stresses exist where the specimen is narrowest, as would naturally be expected. Stresses are practically nil at the outer points of the notches. The illustration Fig. 4 shows the same model in tension.

Here it will be seen that there is an entirely different distribution of stresses.

Fig. 5 shows the pattern of stresses that are produced when a metal plate having a small hole in the center is placed in tension. It is interesting to note that points *C* in the hole are actually in compression.

Investigating the Stresses in Running Gears

Machine elements in motion complicate matters for the machine designer, with his slide-rule, but are an open book when analyzed photo-elastically. Gears are a most interesting example—the photo-elastic apparatus shows the actual ebb and flow of the stresses as the load is passed from one tooth to another. Motion pictures have been taken of "stresses at work," that show clearly the point of maximum stress in gear teeth and the advantage of having several teeth in contact simultaneously.

Fig. 7 shows two celluloid gears set up for taking a motion picture. Loads of various amounts are placed on the gear teeth by turning the handwheel at the left. Fig. 6 indicates how the stresses appear in the meshed teeth as the gears are revolved. In looking at this illustration, it should be remembered that the stress bands vary in color according to the intensity of the stresses.

The photo-elastic method has taught designers many things about gears. It has proved, for instance, that the extensively used Lewis formula for gears neglects strength concentration at the root of the teeth and the effect of distributing the load over several teeth. Photo-elastic analyses take all such important details into consideration. By this method, it has been found that the maximum stress is not at the point of contact between gear teeth, as was formerly thought, but beneath the surface itself. This provides a logical explanation of the mysterious "pitting" of gear teeth or other surfaces in contact.

The fillets between gear teeth show up as weak spots. Thus, by connecting two gear teeth with a single semicircular fillet instead of with two small fillets as is usual, the fatigue strength of gears has been greatly increased. Making the gear tooth contact larger improves the load distribution and the stress cycle. When more than one tooth is in contact at a time, the load is not generally divided equally between them, because the stresses depend on the relative "give" of the teeth. With stub teeth, the stresses in the compression fillet are higher than those in the tension fillet, because the compression stresses penetrate into the roots of the teeth.

In the Westinghouse shops, huge rotors of turbo-generators are constructed of metal plates held together by from four to six large bolts. These rotors range up to 55 inches in diameter, and run at such a high speed that a point on the rim travels approximately 300 miles per hour. Obviously, no chances can be taken in designing such units. Recently, a photo-elastic research was conducted to determine the best type of thread for the bolts used in these rotors. It was found that the first two

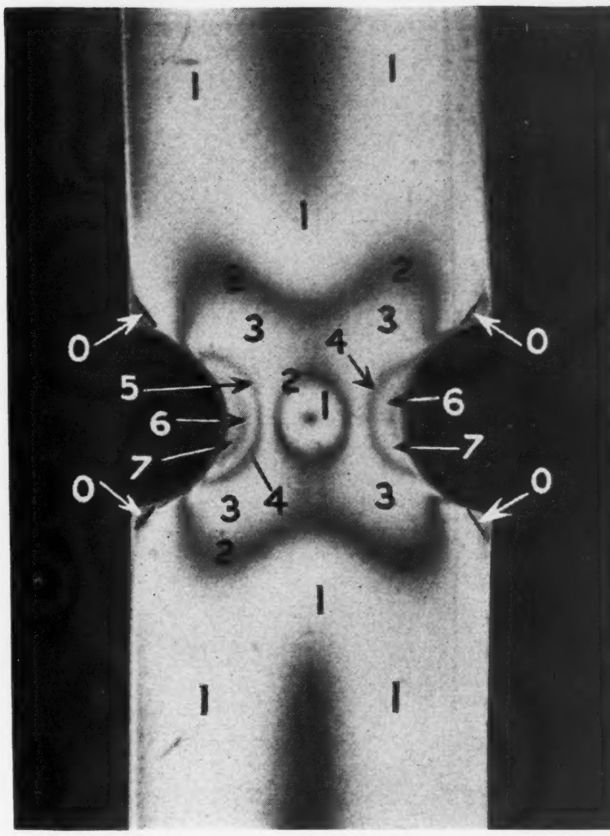
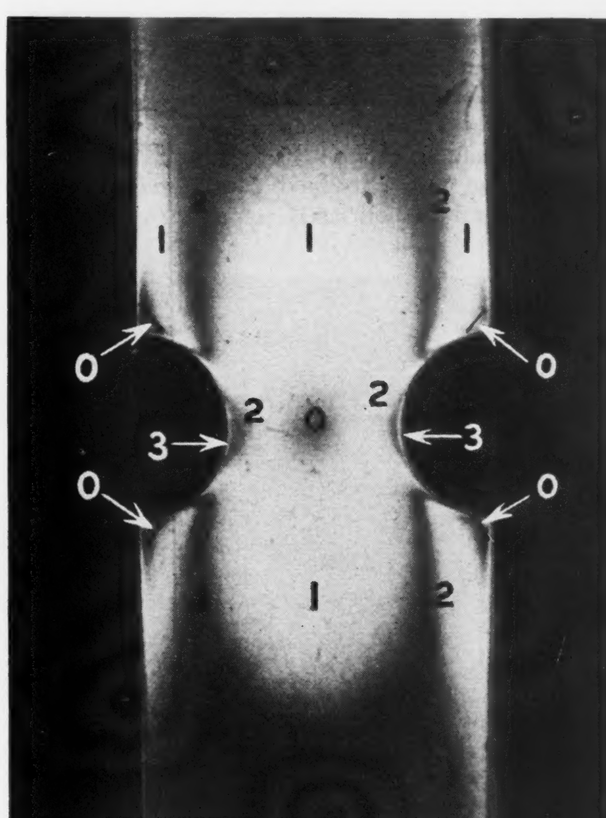


Fig. 3. (Above) A Pattern of Stresses Obtained in Bending a Notched Bar
Fig. 4. (Below) Stresses Occurring when the Same Model is in Tension



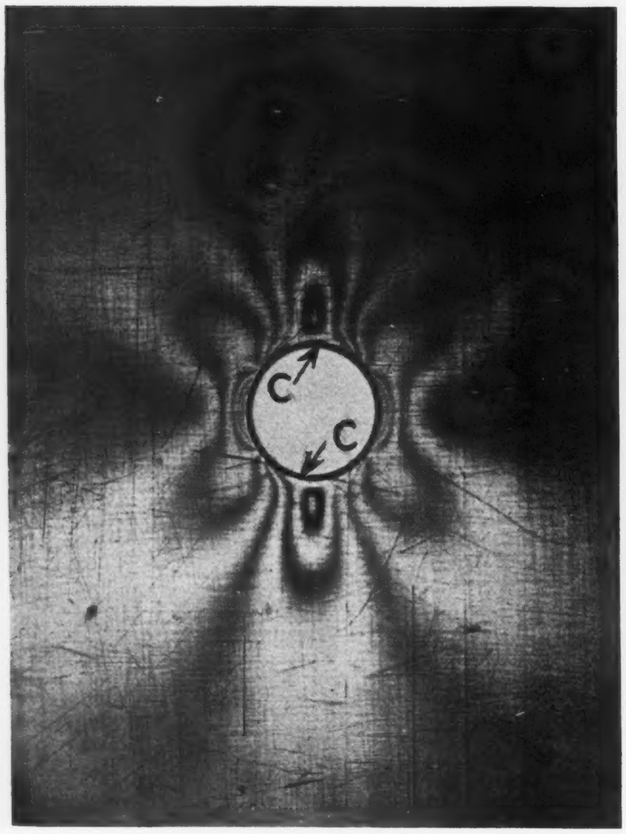


Fig. 5. A Celluloid Model with a Small Central Hole is Shown Here in Tension. The Points C are Actually in Compression

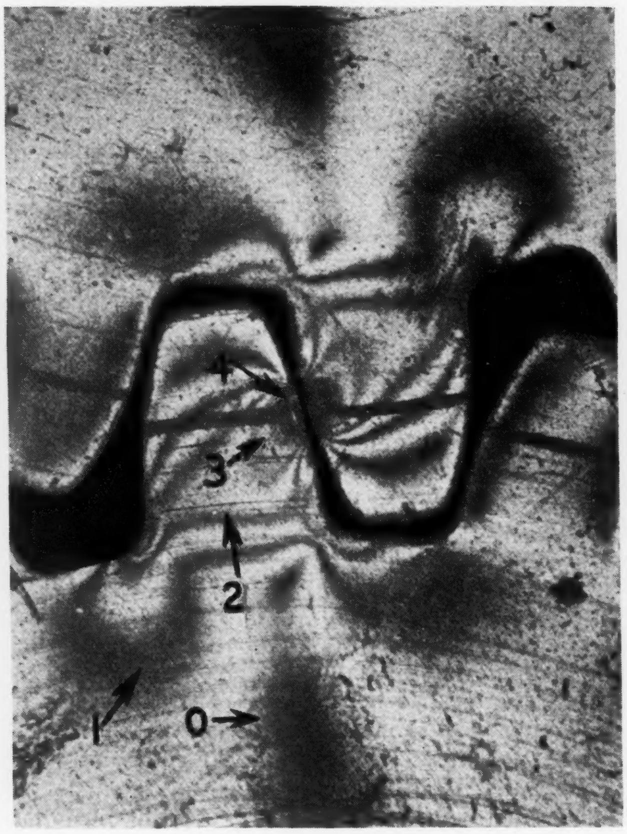
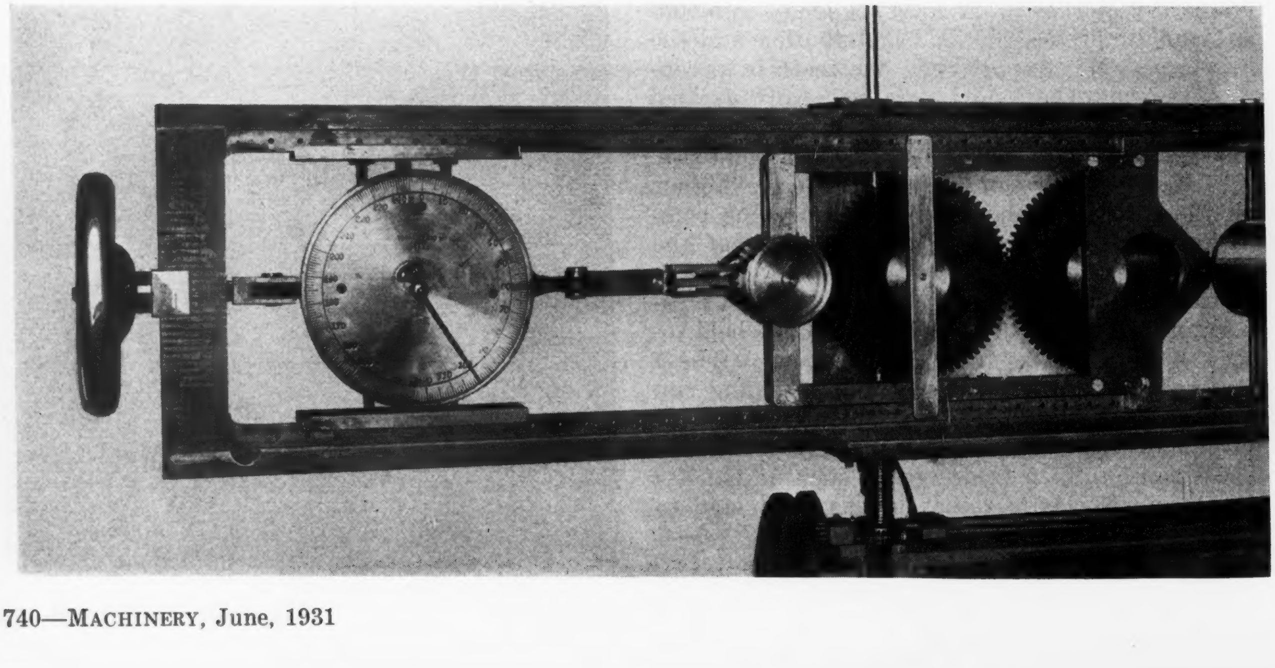


Fig. 6. When Two Gears are Revolved in Mesh, the Photo-elastic Apparatus Shows a Constantly Changing Color Map

threads carried five-eighths of the total load, and the last thread less than one-eighth. A modified Acme thread was adopted. It was also found possible to decrease the size of the nut and thread from 1.4 to 1 inch in diameter, and yet the nut remained stronger than the bolt itself.

Fig. 7. Celluloid Gears Set up for Taking a Moving Picture of Changing Stresses that Occur when the Gears are Revolved

Another practical application of photo-elasticity has been made in studying turbine blades. The tips of the long slender blades in the low-pressure end of steam turbines are perhaps the fastest moving man-made things in the world, with the exception of a bullet, as these tips travel



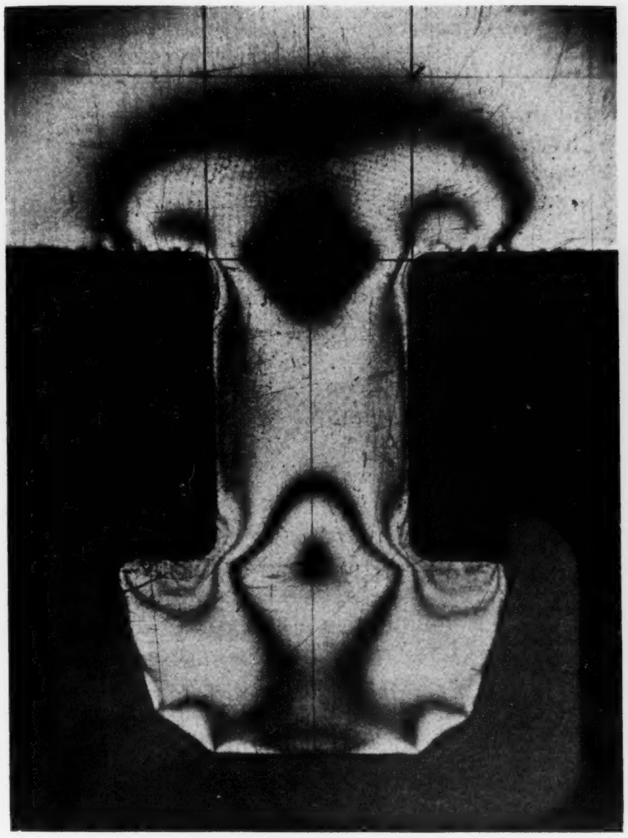


Fig. 8. Photo-elasticity has Shown that Slight Changes in the Design of Dovetails Materially Alter the Stress Distribution

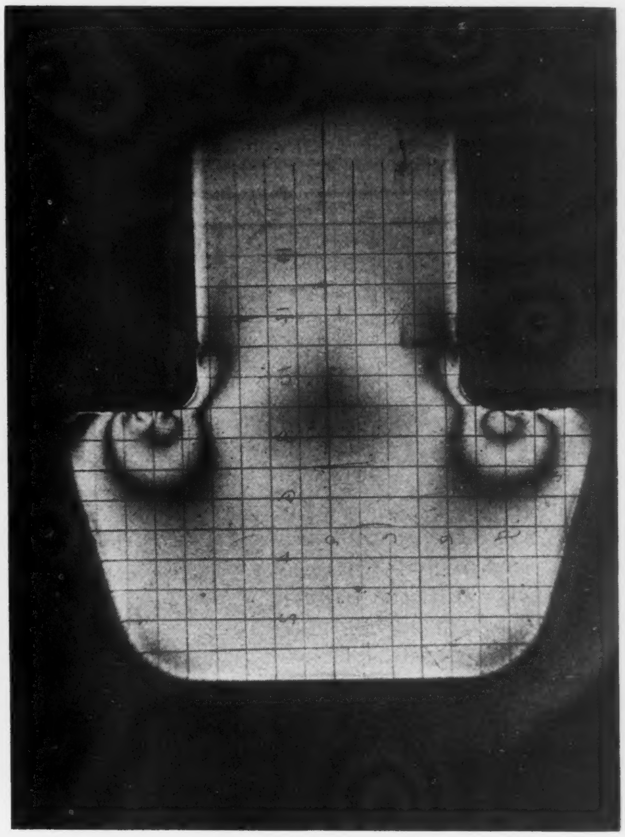
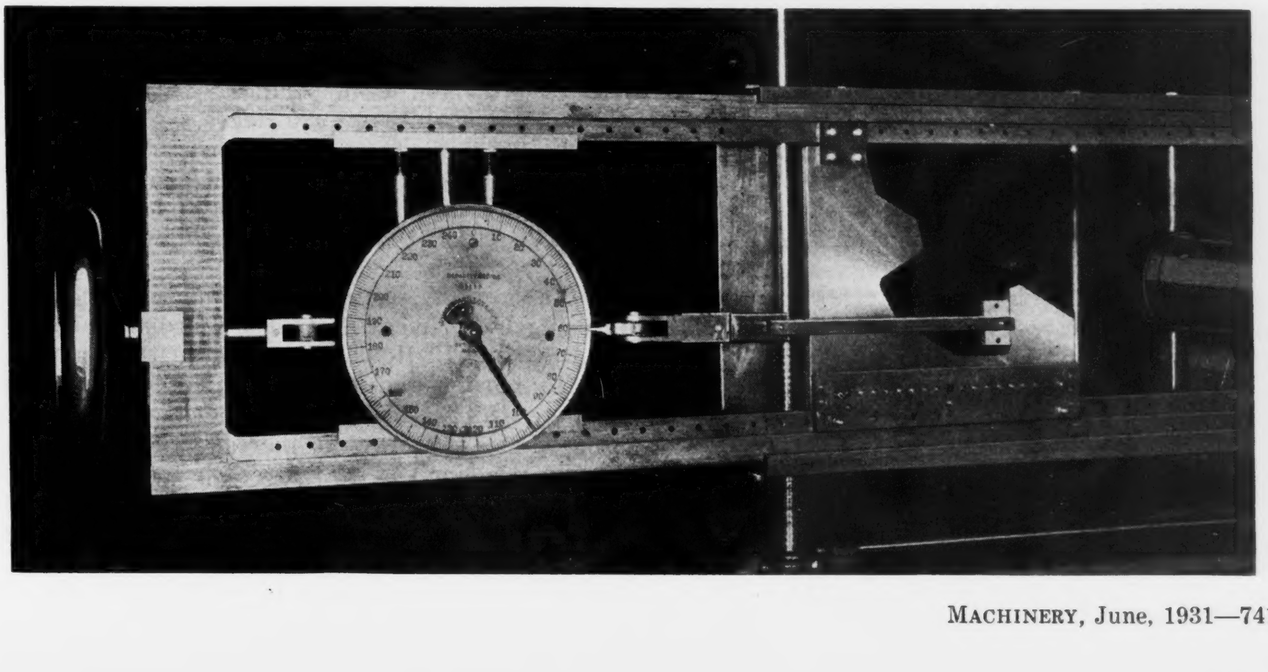


Fig. 9. The Different Distribution of the Stresses in Dovetails may be Seen by Comparing this Picture with Fig. 8

about twelve miles a minute. Because of the small clearance between the whirling turbine rotor and its casing, any excessive growth or "creep" that might occur in the length of the turbine blades as time goes on might wreck the turbine. Photo-elastic apparatus will show what is the highest working stress that can be placed upon the blades if they are to remain within the allowable deformation. With ductile materials under a steady load, the designer is less concerned about breakage than about prohibitive deformations that may become fractures.

Fig. 10. Close-up View of the Frame by Means of which Loads up to 250 Pounds Can be Placed on the Celluloid Models



In Fig. 10 the photo-elastic equipment is shown set up for investigating the model of a dovetail used in revolving electrical machinery. By means of photo-elasticity, the best dovetail shape has been determined for various requirements. Figs. 8 and 9 show how the distribution of stresses varies widely with the dovetail design.

Hardened steel, cast iron, porcelain, concrete, and other brittle materials often break without warning. A simple change made in porcelain insulators after a photo-elastic study increased their strength 15 per cent. Concrete structures, too, have been improved, after it was seen how the stresses were distributed, by shaping and placing steel reinforcing bars accordingly.

Although at present little known outside of the large research laboratories, the photo-elastic method of observing stresses is often the easiest, and in many cases, the only solution to complicated problems. The general application of the apparatus seems almost unlimited, and its use in industry will undoubtedly increase.

How to Obtain Best Results in Nitriding

Composition of Steel Adapted for Nitriding, and Variations in Treatment to Secure the Required Properties in the Product—Second of Two Articles

By J. H. CATES, Jr.
Industrial Heating Engineering Department
General Electric Co.

TYPICAL results obtained in nitriding steel parts and the equipment employed in applying this process were described in March MACHINERY, page 489. The present article deals with the effect of the composition of the steel, methods of preparing the work, and results obtained by modifying the nitriding process.

The principal factors involved in nitriding that are subject to variation within certain limits are: (1) Composition of the steel to be nitrided; (2) temperature at which the nitriding takes place; (3) length of the nitriding cycle; and (4) pressure of the ammonia gas in the nitriding retort.

Composition of Steel Suitable for Nitriding

Dr. Adolph Fry of the Krupp Laboratories, Essen, Germany, in studying the combining power of nitrogen with various elements, discovered that aluminum formed the most stable nitrides, followed by molybdenum, manganese, chromium, vanadium, titanium, and tungsten in the order named. Using these elements, Dr. Fry experimented with various steel alloys, finally evolving alloys of the following analysis: Chromium, 1.30 to 1.80 per cent; aluminum, 1.30 to 1.80 per cent; molybdenum, 0.20 to 0.30 per cent. It was found that the percentage of carbon had little effect on the properties of the nitrided steel, except that the steels lower in carbon seemed to reach a given penetration or depth of case quicker than the higher carbon steels. At the same time, there appeared to be more of a tendency for the treated parts to show grain growth and brittleness in the case of low-carbon steels. These advantages and disadvantages were weighed against each other in order to obtain the most satisfactory percentage of carbon.

Later it was discovered that the percentages of the alloying materials could be considerably decreased without affecting the hardness or toughness of the case appreciably. Naturally, the machining and forging properties of the nitrided steels were much improved by decreasing the percentages of these alloying agents. An alloy typical of those now in use has approximately 0.3 per cent carbon, 1 per cent aluminum, 1 per cent chromium, and 0.2 per cent molybdenum, with very small percentages of other alloying elements. The molybdenum serves as a binding agent, tending to maintain the properties of both the core and the nitrided case and thus improving the impact resisting properties of these metals.

The latest development in connection with nitrided steels is the addition of a small amount of sulphur. It is claimed that steel thus produced compares favorably, as regards hardness and resistance to corrosion, with the standard steel developed for nitriding. The tensile strength and impact values of the sulphur-content steel, after nitriding, also compare favorably with those of the standard product having a like carbon content. The machining qualities of the new steel are claimed to be superior.

Effects Obtained by Varying the Temperature

The temperature at which the nitriding takes place has a marked effect on the quality and character of the hardened surface. Nitriding at the lower temperature of 900 degrees F. produces a fairly thin but extremely hard case, while nitriding at a higher temperature results in a case that is somewhat softer but considerably deeper.

The length of time the work is allowed to remain in the nitriding furnace also has a decided effect on the case. A series of tests made at the Engineering Experiment Station of Purdue University by Raymond H. Hobrock shows that the maximum surface hardness occurs after nitriding for approximately thirty hours. This hardness decreases somewhat as the time is increased, but the depth of the case increases in direct proportion to the time. A heating period of about forty hours seems to give the best combination of surface hardness and case depth.

Tests were also made to determine what effect the pressure of the ammonia gas had on the process. In these tests, the pressure of the ammonia gas was varied from five to six hundred millimeters above atmospheric pressure and the hardness measured at various depths from the outer surface. It was found that increasing the pressure does not affect, to any great extent, the time required to reach maximum hardness, but it does increase the depth of the case considerably, and it also tends to decrease the surface hardness if the heating cycle is prolonged more than twenty-five hours.

From these tests it appears that practically any desired characteristics within certain limits can be imparted to the nitrided parts by varying the temperature, the time of treatment, and the pressure of the gas.

A heating cycle developed for production work which has been found to be very satisfactory by the General Electric Co. for a particular application consists in holding the material to be nitrided at a temperature of about 930 degrees F. for thirty hours, after which the current is shut off and the charge allowed to cool to about 390 degrees F., with the ammonia gas passing through the retort that contains the work. The ammonia is then cut off and the work allowed to cool to about 210 degrees F. before the charge is exposed to the air.

Recently "Duplex" cycles have been introduced, in which the charge is held at a low temperature of 925 to 975 degrees F. for the first half of the cycle, the temperature then being raised to 1180 to 1200 degrees F. for the remainder of the cycle. The "Duplex" cycle seems to combine to a satisfactory extent the properties of surface hardness and case depth. The length of time required for nitriding is also reduced by employing the "Duplex" cycle.

Preparing Work for the Nitriding Process

Certain precautions should be taken in preparing parts for nitriding. In the first place, sharp corners and edges should be removed, if possible, in order to prevent "spalling" or flaking, which may occur where there is a thin cross-section or a sharp edge. It is also necessary to remove all decarburized material from the surface of the steel block from which the part is to be made. This may be done by removing at least 1/16 inch of metal from the surface of the bar or block as it comes from the steel mill. The part is then rough-machined to size.

Before nitriding, the steel must be in the so-called "sorbitic" condition. This may be brought about by quenching in oil or water at temperatures of from 1600 to 1800 degrees F.; the higher the quenching temperature, the tougher the core and the better the physical properties of the piece. After quenching, the steel must be tempered to facilitate machining, the temperatures being from 1000 to 1300 degrees F., depending upon the amount of machining to be performed. The part is next finish-machined to size, allowance being made for the tendency of the part to "grow" during the nitriding operation. In some cases, this growth may amount to from 0.001 to 0.003 inch on the diameter, depending on the length of the nitriding period.

Care must be taken to remove any decarburized surface that may have formed during the quenching and tempering operations; otherwise the surface of the part is certain to flake after nitriding.

If part of the surface does not need to be nitrided, the decarburized area may be covered with a good grade of aluminum paint to prevent the scale from dropping off on the other pieces in the retort.

The charge, or work to be nitrided, is "laid" in the retort in any manner desired, but individual layers should be separated from each other by heavy nickel wire screens, in order to insure complete penetration of the ammonia gas. After the retort has been placed in the furnace and the gas has been connected, the ammonia gas is turned on and allowed to pass through the retort for some time in order to insure complete dissipation of the air in the retort. This will eliminate discoloration.

During the nitriding cycle it may be necessary to shut off the electric current due to failure of the power supply. If this shutdown is of short duration, the ammonia gas should be kept circulating through the retort, but this time should not be figured in on the nitriding period.

Protecting Surfaces that are to be Left Soft

When it is desired to protect certain portions of a piece, such as screw threads, from the action of the ammonia gas, the best and easiest method is to nickel-plate such surfaces to a depth of at least 0.005 inch, keeping the voltage as low as possible to prevent sponginess of the plate. With a solution of one-third single nickel salt and two-thirds double nickel salt and a current of two volts, about twenty minutes in the plating bath will be all that is required.

Various other methods can, of course, be employed to protect the surfaces that are to be left soft. For general production work and wherever

85,000 Chromium-plated Gages Used in One Plant

The chromium-plating of gages is thought of generally as a means of salvaging gages that have worn beyond the specified limits. The use of chromium-plating for this purpose, however, is by no means its most important application in this field. Chromium plate wears much longer than a hardened steel surface. That being the case, why should not gages be chromium-plated when new? This question has been so effectively answered by one of the largest automobile manufacturers in the world that today, in one plant alone, 85,000 chromium-plated gages are in use. The details of this interesting application will be given in the leading article in July MACHINERY.

a final machine operation is to be performed after nitriding, tinning is perhaps the best method. Either metallic tin or 50 per cent lead and tin may be used, with a flux composed of 500 cubic centimeters of hydrochloric acid, 250 cubic centimeters of water, and 15 grams of ammonium chloride "killed" by means of scrap zinc. The parts to be tinned must be cleaned and dipped into the molten metal and kept there until they become sufficiently heated to prevent the tin from solidifying immediately upon the removal of the parts from the bath.

For production work, the entire part should be tinned just before the final machining operations. The portions to be hardened can then be finish-machined, care being taken to remove at least 0.0005 inch of the tinned surface, as the tin will protect the surface to that depth. For small parts and small production work, a very successful means of protecting a surface is to apply a paste composed of stannous oxide and silicate of soda. Under the action of heat, the stannous oxide turns into metallic tin.

The directions for obtaining satisfactory results by nitriding given in the article published in March MACHINERY and in the present article will enable the user of this process to apply it to advantage for many purposes.

* * *

Misdirected research is as bad as no research at all. Some people seem to think that research is a panacea for all the ills of modern industry. They believe that all a concern has to do is set up a laboratory, hire engineers, and its future prosperity is assured. We have a great tendency in these days to put the cart before the horse.—*Charles F. Kettering, Vice-president and director, General Motors Corporation*

Inexpensive Slotting and Bending Tools

By CHARLES H. WILLEY, Concord, N. H.

About 2500 retaining rings for voltmeters, like the one shown in Fig. 1, were required recently to fill a special order. The voltmeters were to be used in portable testing instruments for radios, and the retaining rings were made to fit around the voltmeter cases. The rings were fitted with three screws for drawing the meter into the panel.

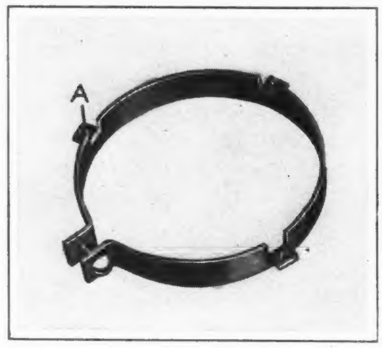


Fig. 1. Retaining Ring for Mounting Voltmeters on Panel

As only a small quantity of rings was required, it was necessary that the tool equipment for the job be very inexpensive. The rings were cut from tubing in the lathe, and the three ears or side lugs *A* formed, one at a time, by the punch press tool shown in Fig. 2. The punch *B* is slotted at *C*, as shown in the view in the upper left-hand corner. This slot fits over the projecting tongue *D* of the die member. On the down stroke of the press ram, the punch shears and bends the ear. After the first ear *A* is bent, the ring is indexed or turned around so that the ear is located against the pin *E* for producing the second ear. Thus pin *E* gages the spacing of all three ears.

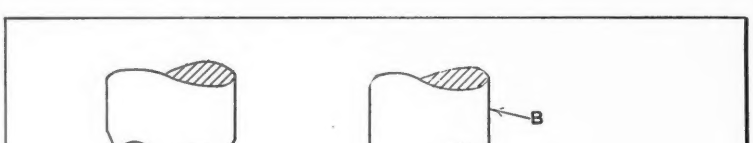


Fig. 2. Punch and Die for Producing Lugs or Ears A on the Part Shown in Fig. 1

After forming the ears, a section is cut from the ring, using the punch shown in Fig. 3. This operation brings the ring to the correct size. The work is located by positioning the ear against a pin *F*, as indicated, the work being shown in dotted lines. Next, a right-angle bend is made in each end of the ring, using the simple combination jig shown in the lower view, Fig. 4. The ends are bent, one at a time, by inserting them in the slot *G* and forcing the ring downward. After being bent, the ends are

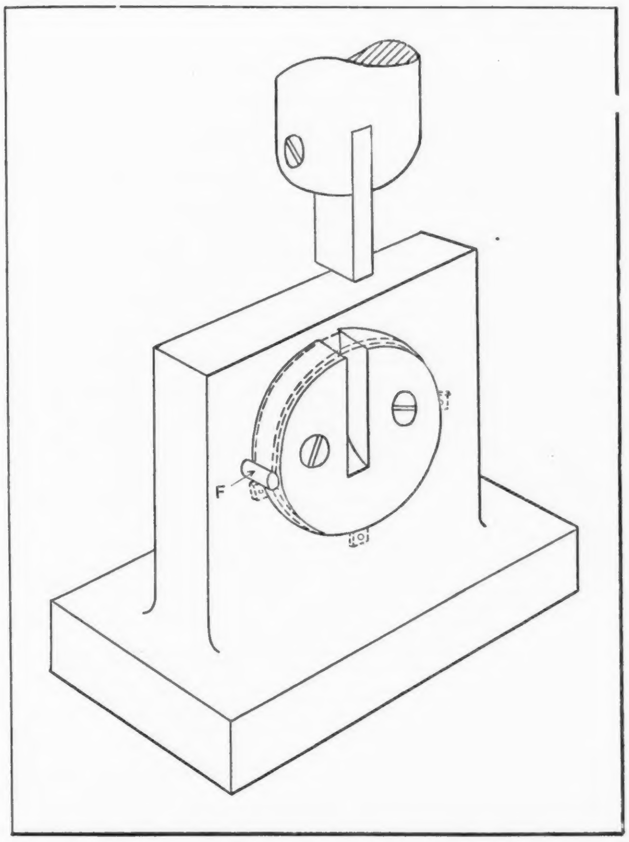


Fig. 3. Die for Cutting Section from Retainer Ring

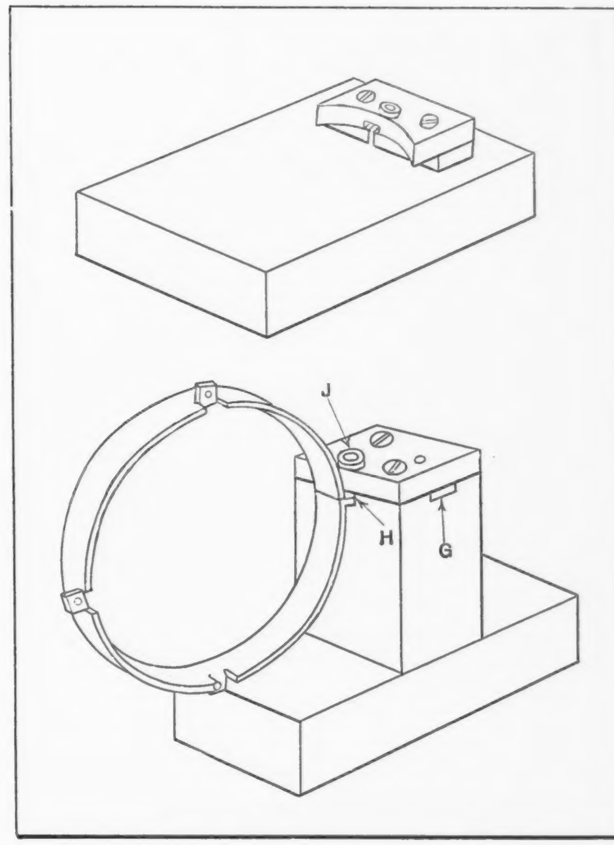


Fig. 4. Jigs for Bending and Drilling Retainer Ring

inserted in the slot at *H* and drilled, the bushing *J* serving as a guide for the drill. The simple jig used in drilling the ears is shown in the upper view of Fig. 4. The entire cost of the temporary tool equipment for this job was only $18, and the parts were produced at a profit of 2 1/2 cents each.

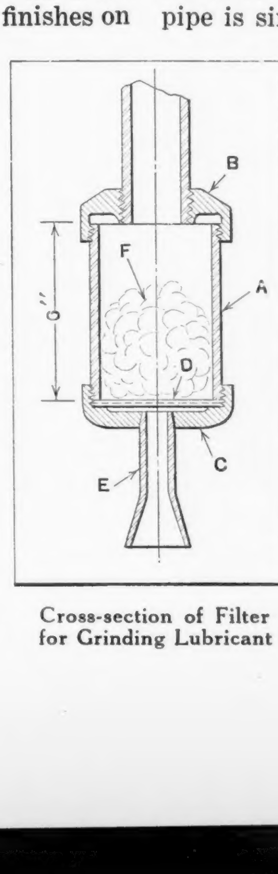
* * *

Filter for Grinding Lubricant

The filter shown in the accompanying illustration is used for removing foreign material from grinding lubricant when producing high finishes on cylindrical work. It has been used for some time in the Norton factory at Worcester, and was described by Lloyd E. Paine in *Grits and Grinds*.

After any grinding machine is in operation for a while, the lubricant will contain small particles of metal and bits of abrasive. Much of this lodges in the settling tank, but some of the finer particles are held in suspension and are carried back to the work. Here they become squeezed between the wheel and work, with the result that fine marks are produced on the surface, which are objectionable on highly finished work.

These difficulties were overcome by using the filter here illustrated. Besides permitting a better finish to be obtained, the filter obviates frequent cleaning of the settling tank, so that production is interrupted less frequently. The filter consists simply of a piece of 3-inch pipe *A* threaded at both ends; cast-iron caps *B* and *C* screwed on the ends of the pipe; a piece of No. 80 mesh brass screen *D* secured between the lower cap and the end of the pipe; the nozzle *E;* and filtering sponge *F.*



Cross-section of Filter for Grinding Lubricant

Various materials have been used in the filter with success. Good results have been obtained by using an ordinary sponge or steel wool. In some cases, a combination of these two materials is believed to be more effective. To clean the filter, the pipe is simply unscrewed from the upper cap, and the sponge or other filtering material removed and washed out.

* * *

Meeting of the Taylor Society

At the Philadelphia meeting of the Taylor Society, held at the Hotel Benjamin Franklin April 30 and May 1, the main subject discussed was planning as applied to sales, production, and administration. Among the papers read were: "Planning Sales"; "The Need for Planning for an Entire Industry"; "Planning Production"; "The Planning of Labor Relations"; "The Relation of Cost Accounting to Budget Making"; "The Planning of the Work of the Office Staff"; and "The Need for National Planning for American Industry."

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

I believe that orders should always be orders, but that the employe should have a right to express his opinion in a helpful manner, and that it should be respected by his superior. When trouble is experienced from orders, it is usually due to the fact that neither side stops to explain his viewpoint. An order is often given without an explanation and is either obeyed or modified without explanation. If the worker considers an order unwise, he should always be permitted to explain why he thinks so; then, if the original order is either explained to his satisfaction or he is told to carry it out under any circumstances, there is nothing further for him to do but to carry out the instructions.

FRED J. SCHIMPF

How to Handle Suggestions of Doubtful Value

Suppose that a shop man makes several suggestions to his foreman that he considers worthwhile but that the foreman thinks will not work to satisfaction. How should the foreman handle the situation?

The first rule should be to listen carefully to all suggestions whether they seem to be worthwhile or not. When they appear to be of doubtful value, do not turn them down at once, but pick out the apparent flaws one at a time. The suggestion should be talked over in a friendly way with the man who offers it, and each weakness in the idea should be pointed out. Then, the man himself, if reasonable, will be the first one to admit the fact that his idea is impractical and he will not be antagonized, because of the friendly manner in which his mistake was pointed out.

There is no better way of discouraging all suggestions and progress than to state abruptly that an idea is of no value without giving the reason why.

JOHN A. HONEGGER

The Education of a Jobbing Shop Manager

The education of mechanics generally consists of grade schooling and an apprenticeship. Some take correspondence courses, but too few acquire serious habits of reading and study. Their understanding of mathematics and economic factors is seldom sufficient to serve as a guide in conducting a business, yet their mechanical ability is of such importance that it secures for many of them the managership of a jobbing shop. Is it surprising, then, that jobbing shops generally are not conducted on sound business principles? Their managers follow trade customs blindly, honoring them because that which is, seems right. Is not this a matter that can be cured only through education?

For example, there is need for a new trade custom in connection with bidding for contracts offered by manufacturers. Today, if a bidder wishes to know, after the contract has been placed, how his bid compares with others submitted, he is likely to be told that the buyer feels it his privilege to deny such information. Under such conditions, it seems that the bidders give the buyer free and valuable cost information, readily applied to his own special work, without having the right to obtain similar knowledge for themselves, based upon their own bids. The bidders place themselves at the mercy of the buyer.

This custom has prevailed for generations. It is obviously unsound. Why, then, do bidders persist in supporting it? Is it because the limited education of mechanics leave most jobbing shop owners incapable of formulating a new trade custom fair to all? If this is the case, an educational organization of jobbing shop owners should prove exceptionally valuable for improving the conditions in the industry.

J. H. STERNBERGH

An Inventory of Men

The practice of keeping an inventory of the men in the shop should be applied more extensively. This is a good time to classify the men—while business is quiet. The record will be of great value later.

Every employe should be asked to fill in a blank indicating what work he is able to do in addition to that on which he is engaged. He should place the different items in the order in which he considers himself most skilled. Charles Smith, for example, might make out a list as follows: (1) Assembling; (2) drilling; (3) millwright work; (4) turret lathe work; (5) carpentry. If possible, it is advisable to verify the statements made by the men.

It is surprising how much unexpected experience is available. I have known of drilling machine operators who were good tracers, a milling machine operator who was an expert in indexing and other clerical work, and a machinist running a lathe who was such a good writer that the firm made use of his ability in this direction by having him write

descriptions of equipment for catalogues and trade journals.

Often a skilled lathe operator is hired for assembly work because there is no other work for him at the time, and, later, his actual trade is lost sight of, and is not thought of again when a vacancy occurs in the lathe department.

An inventory of this kind is of great value when business falls off, as it assists the company in holding the most valuable men. It is of great value if a man can do more than one job. With a force so trained, the company's work can often be done with fewer men, all of whom are more certain of working full time.

There should also be in the inventory a record of the personality, executive traits, and general character of every man. This makes it easier to select men for promotion when vacancies occur.

SIDNEY BEAUJON

Should Production be Guaranteed?

In purchasing machine tools, we machine tool users buy production, not mere machines. We are interested in knowing what the machine will do, and we feel that we are entitled to know how much the machine is capable of producing of a given quality.

I believe that a great deal of misunderstanding between machine tool manufacturers and their customers could be avoided if the customers would be more specific in their requirements. To demonstrate what I have in mind, I will give as an example our method of buying, say, a turret lathe.

We specify that the machine should be equipped with adjustable anti-friction bearings on the main driving shafts and spindle, that all main driving gears should be made from heat-treated steel and run in oil, that the carriage and turret should be equipped with rapid traverse and power feed in all directions, and that there should be power cross-feed in both directions. The remainder of the specifications are left to the judgment of the manufacturer.

We then ask for a production guarantee—not an estimate. This guarantee is asked for on a basis of nine hours per day, and also for a fifty-hour week. We are not interested in floor-to-floor time for one piece. The work to be done on the machine is clearly shown on a blueprint giving the kind of material, the amount of stock to be removed, and the finish required. To us price and delivery date are less important than the productive capacity of the machine.

With such specifications as a basis, there should be very little cause for misunderstanding between seller and purchaser.

H. C. MEYERS

A Rating Card for Toolmakers and Machinists

Referring to the article "A Rating Card for Toolmakers and Machinists" in April MACHINERY, page 622, I would suggest that while the system described provides for satisfactory ratings within a department, it does not provide for equitable compensation as between departments. Foremen differ—some are generous and easy, some exacting and strict. Consequently, one department might have a high average rate of pay and another might have a low rate, in spite of the fact that the men in each department averaged about the same in skill and speed.

For this reason, it would be an improvement on the method described to budget the total expenditure allowed for each department for a given number of men. It might be better still to fix a classification of pay according to the number of men in the department. For example, if there were fifty employes, it might be specified that five should receive the highest rate of pay, six the next highest, eight the next, and so on. Then the foremen, instead of marking in terms of percentages, would simply pick out five No. 1 men, six No. 2 men, and so forth. In this way any injustice as between departments due to the personal traits of the foremen would be automatically eliminated.

LEON J. LICHTENSTEIN

Encouraging the Foreman to Study New Equipment

By CHARLES H. WILLEY, Superintendent of Manufacturing, Hoyt Electric Instrument Works
Penacook, N. H.

Recently one of my department foremen sent for a catalogue of a special machine for profiling. A salesman visited our plant and offered to send us the machine on trial. The foreman became as anxious as the salesman to prove the value of the machine, and was able to find many more uses for it than had been anticipated. We found it possible to save time on many odd jobs for customers who were in a hurry for their work, and were able to get some jobs that otherwise would have gone to a competitor.

This is but one illustration of the benefits resulting from encouraging the foreman to study new equipment. We also hold round-table meetings where the latest machines are discussed, the equipment section of technical journals being on hand for reference. Many times we have had to send drawings and samples of our work to machine tool manufacturers to satisfy one of our foremen that we were not losing too much by continuing to make use of our present equipment.

The result of this willingness to consider the suggestions of department foremen in regard to new equipment has made them very alert in keeping informed of the latest developments. We have acquired a number of new machines that have saved their cost in approximately one year and that are now producing a better product at greater profits.

Problems of the Jobbing and Contract Shop

Jobbing and Tool Shops Solve Many Intricate Problems, but Their Chief Difficulties are not Mechanical—Most of Them Need Better Commercial Management

By GEORGE R. TUTHILL
Executive Secretary
American Machinery and Tools Institute

THAT branch of the machinery and tools industry that embraces jobbing, contract, and tool shops may be divided into several groups as follows: (1) Large shops, equipped with heavy machinery for large work, usually specializing in heavy machinery. (2) Large shops building fine tools, dies, and special machinery, both medium-sized and small. (3) Large shops building medium-sized machinery of high quality. (4) Large shops building rough machinery. (5) Large shops building second-quality tools, dies, and machinery. (6) Small shops specializing in very fine tools and dies, and small manufactured products, including stampings. (7) Small shops doing a very rough class of work and general repairing. (8) Large shops doing tool and die work, whose principal business is stamping. (9) Small shops doing tool and die work, whose principal business is stamping.

These shops differ in the following respects: The shop doing large work must have large buildings, cranes, heavy machinery, and plenty of space in proportion to the number of productive workmen. The shop doing fine tool work must be equipped with the finest of precision machinery; it must provide appropriate and comfortable quarters, and requires intelligent and detailed supervision over a much larger number of men. The shop doing the rougher class of work has more latitude in the matter of sanitation, comfort, and equipment. The stamping plants operate on the high-production principle and must provide comfort and proper supervision.

The smaller shops in all classes are frequently found in dilapidated buildings, old stores, or in some out of the way place. It is evident that in each of these branches of the industry the operating burden or overhead bears a different proportion to the number of people employed and to the amount of money paid for productive labor.

As an illustration, the large shop, equipped with heavy machinery, requiring a large building, and employing fewer men per hundred square feet of floor space, would have a burden much greater than some small work-shop into which a dozen or more men have been crowded.

The Tool and Die Shops Need to be Placed on a Thorough Business Basis

The tool, die, and special machinery builders—the group with which this article is mostly concerned—are recognized in the trade as the group of shops that build small- and medium-sized tools, dies, and special machinery, having a certain amount of precision equipment, some manufacturing equipment, and usually a department for stamping work.

This industry is confronted by several problems; in many cases, a stamping shop will contract for stampings and charge the customer for the dies at actual labor cost without any overhead charge or profit. This is done in order to get the stamping business, which carries the burden that should properly be charged to the dies. This is also the case in the Bakelite industry.

Careless Methods of Estimating are Entirely too Frequent in the Industry

One of the major offenders is the concern that does not estimate, but "guesstimates," on contract work, not being seriously concerned about the cost of the individual unit, but counting on obtaining a volume of business at such cut prices as will show a small profit over and above the expenses for the month. The process involved in this "guesstimating" consists in looking at the drawing of the part or a sample stamping and then guessing, without proper analysis, at the cost of the dies or tools necessary to produce the part.

In effect, this would be similar to a building contractor who looks through a set of blueprints for an apartment building, and without measuring or otherwise calculating his material and labor, arbitrarily arrives at a price for such a building; however, there would be a point in favor of the contractor in that he would have similar buildings to compare with, but in the tool industry, there are few duplications and practically no opportunity for intelligent comparison.

Every Job Should be Able to Show an Adequate Financial Return

The demand for tools, dies, and special machinery is not so great that the industry as a whole is justified in digesting this business without a fair and legitimate profit. A reasonable profit should be expected on each individual job, and not on the gross volume which, when averaged over the period of a month, might accidentally show a profit. This would indicate that to quote on work without a proper analysis from an engineering, cost of material, and labor standpoint, calculated with the proper percentage of overhead burden and including a legitimate profit, should be regarded as unfair.

Many buyers are aware of this weakness and some high-powered purchasing agents have developed an excellent scheme for beating down the price of tools, which works as follows: A group of competitors is called to the offices of a prospective cus-

tomer, and each is presented with a roll of blueprints representing parts. These competitors are not permitted to take the prints to their respective places of business, but are all herded together in one room, and are expected to submit quotations within a few hours on several thousand dollars' worth of work.

In the time allotted for these quotations, it is utterly impossible for the competitor to analyze the various jobs properly, and in his anxiety to outbid the others, each will guess at prices and quote wildly on the business. The purchasing agent then places the business with the lowest bidder, at his convenience—possibly a week later—and as the old saying goes, "The fellow who made the mistakes and bid too low, will get the business."

It seems that those in the die and tool industry (where the highest degree of intelligence and mechanical ability is a daily requirement) should oppose such practice and refuse to quote prices under any such circumstances.

In cases such as those just mentioned, the purchasing agent is not concerned about the financial responsibility of those who quote, but will take reasonable precautions to place the business with such concerns as are reliable, although using the quotations of one to beat down the prices of the other.

No Industry Needs Proper Cost Accounting More than the Tool and Contract Shops

Many tool shops operate without a proper cost accounting system or a knowledge of the principles of the overhead burden. Some important factors are overlooked entirely, such as depreciation, interest on investment, and appropriate salary for the owner. Two factors that are overlooked, and are an inherent part of the business, are (1) the premiums that the job shop must pay to the tool and die fraternity in training men in the art, since the old apprenticeship system has been discarded, and (2) the perpetual losses on jobs taken on contract, which have an uncanny habit of averaging about 12 per cent of the month's business.

The cost of training mechanics should not be overlooked. The tool job shop produces most of the mechanics for the tool-rooms of larger manufacturing plants, and as the labor turnover in the tool shops is very great, the burden that is carried by the jobbing shop is heavy.

Items that are Frequently Overlooked in Estimating Tool Work

With reference to the second factor, years of experience have proved that in estimating work that must be figured close to meet competition, many items are overlooked, such as the cost of screws, dowel-pins and bushings, hardening costs, and the need for substituting higher-priced materials for those originally estimated, such substitution being due to the peculiar characteristics of tool steels during the hardening and heat-treating processes.

A common experience is the additional cost in labor and material that results from the distortion in hardening of dies and punches, and the frequent breakage or cracking due to thin sections, which, in many instances, cannot be avoided. It frequently happens that this distortion requires as much work to rectify as was needed to produce the part in the first place, there being no alternative but to slowly lap, grind, or otherwise carefully remove portions that have bulged, sprung, or become distorted in some other way.

Occasionally a die or punch will crack or become distorted so badly that it cannot be used under any circumstances and must be made over. Another item usually overlooked is the cost of inspection. This is rarely included in the estimate. The same is usually true of designing expense.

The Tool Shop Owner Seems to Think that it is Wrong to Make a Profit

There appears to be a strange psychology in this industry. The job shop owner seems to feel that it is unethical to take a fair profit on his product and most cautiously conceals the idea from the customer that he is making a profit—if he is. All businesses are organized to make a profit; otherwise they cannot stay in their respective fields or render the service for which they are organized. This is a self-evident truth. To make this truth clear and evident to those who are engaged in the jobbing shop and tool industry is one of the problems that the American Machinery and Tools Institute, with headquarters at 40 N. Wells St., Chicago, Ill., is trying to solve. Owners of jobbing shops who are interested in promoting a better condition in the industry are invited to correspond with the Institute. Trade associations have accomplished important work for the benefit not only of themselves but of the industries that are their customers in other branches of the machinery industry. Work of a similar kind needs to be done for those in the jobbing shop and tool industry.

* * *

Automotive Engineers' Production Meeting

The Society of Automotive Engineers, in conjunction with the Milwaukee Section, held a spring production meeting at Milwaukee, Wis., May 7 and 8. C. B. Crockett, of the Industrial Truck Association, read a paper describing the use of power-driven industrial trucks in automotive plants. T. H. Wickenden, of the International Nickel Co., read a paper covering nickel alloys in automotive manufacturing. New developments in surface hardening of steel and the effect of these developments on the cost of production, were covered in a paper by H. E. Koch, of the Hevi-Duty Electric Co. Frank W. Curtis, of the Kearney & Trecker Corporation, presented a paper entitled "Latest Developments in High-speed Milling with Tungsten-carbide and Tantalum-carbide Cutters." This paper is abstracted in this number of MACHINERY.

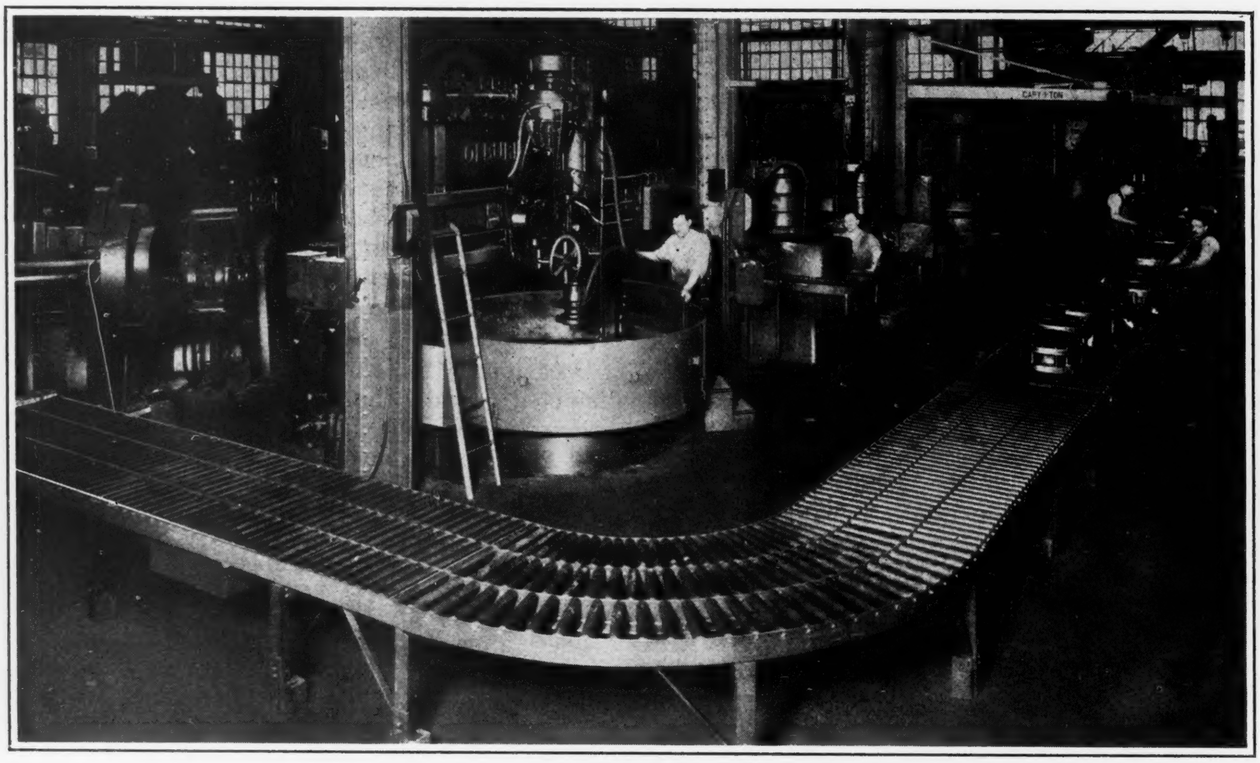


Fig. 1. Roller Conveyor Installed in a Die Grinding and Repair Department to Expedite Handling of Work, Reduce Labor, and Eliminate Congestion

Die-room Conveyor Pays for Itself in Less Than a Year

CONVEYORS are commonly used in the production departments of large industrial plants for speeding up the handling of work, but they are not used so extensively in departments engaged in the maintenance of equipment. Two years ago, it was decided to install the conveyor here illustrated in the die grinding and repair department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., with a view to eliminating congestion of work.

This conveyor has saved $5000 each year since its installation by reducing the time required for handling the work—not as estimated by mere bookkeeping figures, but in the actual time allowed for die handling on the operation sheets provided for the jobs. Since the conveyor cost approximately $4000, this means that it paid for itself in less than a year through saved handling time alone. In addition to this considerable saving, the installation had the important advantages of reducing fatigue of the operators, enabling a more even flow of the work to be maintained, and increasing the floor space around the machines.

Fig. 2. Transfer Table that Facilitates Moving Heavy Dies around a 90-degree Corner of the Conveyor

Previous to the installation of this conveyor, it was the custom to place

the dies on the floor as they were received. Later on, when any particular die was wanted, it was frequently found beneath one or two others which had to be shifted by means of a hoist. Under the new arrangement, all incoming dies are placed directly on the conveyor at the end seen in the foreground of Fig. 1, and strict orders have been issued that they are never to be stacked upon one another.

The conveyor is about 110 feet in length and extends between various machine tools on one side and a bench on the other. At one point, as may be seen in the background of Fig. 2, a spur line branches off and extends along the wall to carry certain parts to a chipping bench and several small machine tools.

In the foreground of this illustration may be seen a transfer table that carries the dies in a direction at right angles to the main section of the conveyor. This table has a series of narrow rollers or wheels mounted on a frame which can be lifted by a lever to raise the wheels slightly above the tops of the long rollers, so that the dies can be conveniently pushed on the table from the main conveyor. The frame is then lowered to enable the dies to be slid on the long rollers, from which the transfer to the conveyor extension is easily effected.

Notes and Comment on Engineering Topics

It is of interest to note that 20 per cent of the automotive export shipments from the United States in 1930 consisted of replacement parts, accessories, and service equipment. This is the largest percentage ever recorded.

An experimental boiler, to be used at a pressure of 3500 pounds per square inch, has been built by the Babcock & Wilcox Co. for Purdue University. With this experimental boiler, the engineering department of the university plans to investigate steam at and above the critical pressure—the point at which steam and water have the same density.

The latest word from Detroit is that several automobile manufacturers are experimenting with chromium-plated cylinder bores in an effort to obtain surfaces that will offer maximum resistance to wear. While the depositing of chromium in cylinder bores is said to be expensive at present, economical methods will probably be developed if this process should prove desirable.

In the new tractor plant completed last summer for the Soviet Republic largely by American architects, manufacturers, and engineers, it is expected that 30,000 tractors will be built annually. The total cost of the plant is stated to have been over $35,000,000. Another tractor plant is under construction, which it is expected will be completed by the end of this year. This plant will be capable of an annual production of 50,000 caterpillar type tractors. A third plant, to be completed this summer, will have an annual output of 50,000 ordinary farm tractors. In addition, the already established Putilov Works in Leningrad are being increased in capacity with a view to producing ultimately 35,000 tractors a year.

The statement has often been made that the large buildings in New York City are placing a tremendous additional weight on the area that they cover, and it is feared that this additional weight might at some time cause the support of the foundations to give way. However, it has recently been pointed out that the more large buildings that are built, the lighter becomes the load on the ultimate foundation. For instance, the new Chrysler Building, which is over 1000 feet high, weighs approximately 60,000 tons, whereas the rock and earth excavated for its foundation and disposed of at the bottom of the sea, weighed about 130,000 tons.

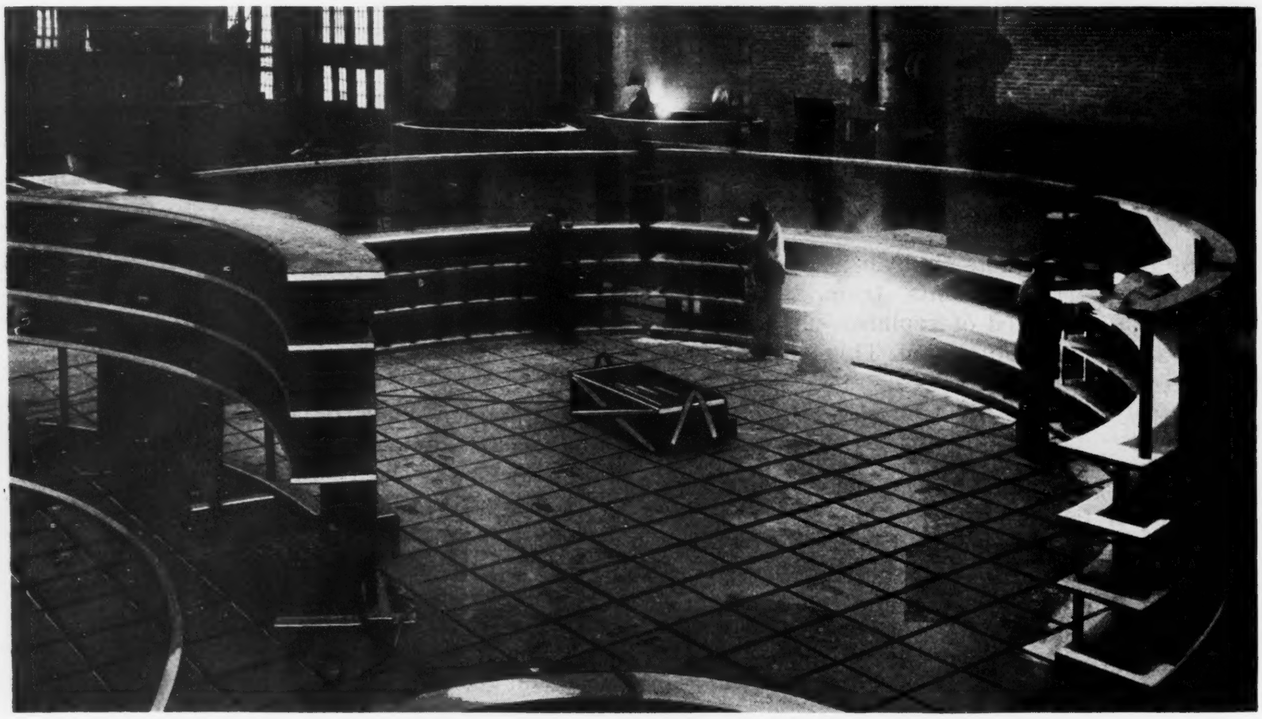
An oil burner control that provides for automatic lighting and relighting of the fire and insures safety against failure as a result of interruption of the electric current or the fuel supply has been developed under the trade name of "The Electrical Brain" by the Phoenix-Detroit Burner Corporation of Detroit. The device is a small electrical unit contained in a steel box adjacent to the furnace, and is especially intended for domestic oil burner installations. When a switch is turned on, the electric current first passes through a lighting element for a period of 90 seconds; it then opens the oil valve and starts the motor. The oil stream is directed over the lighting element and the flame is carried into the combustion chamber. When combustion is established, the current is automatically turned off from the lighting element. If there is an interruption of the current, the oil stream is instantly shut off, so that unconsumed oil cannot

be brought into the furnace. When the current is restored, the device repeats its cycle of operations and relights the fire.

A German engineer has developed a new method for the flame-cutting of metal under water. Instead of using a gas, liquid fuels are employed, such as gasoline or similar fluids that will produce a high temperature. Oxygen is used in connection with the process, the same as in the regular oxy-acetylene cutting process. The liquid fuel is carried from a tank above the surface of the water through a tube to a chamber in which it is gasified. This chamber surrounds the oxygen tube of the torch. The gasifying of the fuel is accomplished by the aid of electrical heating elements. It is stated that steel plates 3/8 inch thick have been cut at a speed of one foot in fifty seconds, using about 34 cubic feet of oxygen and 1/8 gallon of gasoline. The torch is lit in the air and is then brought into the water, where it can be moved back and forth without being extinguished.

The day may not be far distant when an airplane pilot wishing to fly from New York to Chicago will take his plane off the ground, set his instruments on the proper course, and from then on, aside from attending to his engine, forget the operation of the ship until, arriving at Chicago, he takes control again and lands. Such automatic flying is expected as the result of developmental work now being carried on by the General Electric Co. and the Sperry Gyroscope Co. for the United States War Department.

The result of the developmental work, as forecast by aviation experts, will be an equipment involving General Electric directional control and Sperry "attitude" control. Such a combination will not only keep the plane on its proper course, but will also keep it in proper "attitude"; that is, the pilot is relieved of the duty of keeping the plane right side up or in balance. To this equipment might be added the sonic altimeter, also being developed by the General Electric Co. to assist the pilot in taking off and landing.



Arc-welding the Armature Frame for a 37,600-kilowatt Water-wheel Generator at the Plant of the General Electric Company

Essentially this will amount to letting the instruments fly the airplane. Heretofore the pilot has had to act as an intermediary between his instruments and the controls, but the automatic devices will do this for him. This will be especially valuable in bad weather when he cannot see where he is going or how far he is from the ground.

At a recent demonstration at the plant of the Westinghouse Electric & Mfg. Co., an interesting industrial application of the Stroboglow—a portable device which makes rotating objects appear to stand still—was made. This device revealed how much the rim of a giant motor, rotating at a peripheral speed of more than 2 miles per minute, expanded due to the action of centrifugal force. Small variations in the diameter of the rim are easily made visible in this way.

Small Tools and Gages will be Discussed by Mechanical Engineers

At the Meeting of the American Society of Mechanical Engineers to be Held in Hartford, Conn., June 1 to 3, Tools and Gages for Interchangeable Manufacture will Occupy an Important Position on the Program

JUST as June MACHINERY is being distributed to readers throughout the country, members of the American Society of Mechanical Engineers will gather for a regional meeting in Hartford, Conn., devoted largely to problems of machine shop practice. In addition, sessions will be held on management, applied mechanics, power and fuels, aeronautics, textiles, mechanical springs, and education and training. The session on management will be devoted to a discussion of the stabilization of employment.

At the machine shop practice sessions, four papers will be presented. C. W. Boston, professor at the University of Michigan, and C. J. Oxford, chief engineer of the National Twist Drill & Tool Co., will present an exhaustive paper dealing with experiments made on the performance of cutting fluids. The influence of chemical composition and heat-treatment of steel forgings on machineability with shallow lathe cuts, will be dealt with in a paper by T. G. Digges.

Tools and Gages for Interchangeable Manufacture

Thomas F. MacLaren, of the Brown & Sharpe Mfg. Co., will present a paper entitled "Conventional Gages and Their Application to Duplicate Production." In this paper Mr. MacLaren will point out that the possibility of obtaining greater accuracy with present-day machines and tools has necessitated improved gaging facilities. The paper briefly treats of some of the important considerations in the design of gages, describes a number of special applications, and points out the need for standardization in gaging methods.

E. J. Bryant, manager of the gaging and reamer departments of the Greenfield Tap & Die Corporation, will present a paper on "Small Tools and Gages for Interchangeable Manufacture." In this paper Mr. Bryant will point out that it is not economical to check too many dimensions with one gage. Gages are designed to disclose that the product is within the specifications, and except in the case of receiver gages, which check the relation of all of the important dimensions of a part, it is desirable that the gages should check individual dimensions.

Automatic and semi-automatic gaging machines with electrical indicating and selecting devices are being more generally used. This type of gaging equipment requires a very large volume of production to justify the outlay involved, but when the production is continuous, it results in important savings.

The importance of a periodical inspection of gages should be emphasized, not only of the gages used on the product, which, of course, may be subject to inspection at intervals or as they are put into use, but inspection of the master or reference-gage equipment of the factory.

The Inspectors Should not be in the Direct Employ of the Production Department

One of the most important phases of interchangeable manufacture is the organization for inspection. In general, the inspection should be under the control of the general manager, and not the production manager. The primary purpose of the inspection should be to assist the production department to produce acceptable parts.

The author recommends the so-called "first-piece" inspection method, which requires the first piece produced on any given operation to be passed upon by the inspector; there should also be continuous inspection, or provision for the continued assurance that the work being produced by the machine is correct.

Correct specifications from the engineering department result in substantial savings of time and material. When the product is to go to a consumer whose own organization inspects the purchased material, it is highly desirable that the consumer and producer should cooperate on their inspection methods. Much time is wasted and much money spent in shipping back rejected material, when the chief difficulty is that the inspectors are not checking the product in the same manner. Producers are as anxious to make material that passes the consumer's inspection as the consumer is to find it acceptable, and rejections are usually the result of misunderstandings or misinterpretation of specifications. When the manufacturer finds out what the particular inspection requirements and methods of the consumer are, his troubles are usually over.

Present-day inspection for interchangeable manufacture calls for a continuous inspection program from the time the raw material is received—and in some cases before the material is shipped—through all the production operations. This has been found economical to insure the proper production of an interchangeable finished product.

EDITORIAL COMMENT

Every period in history has been labeled in some distinctive manner to differentiate it from the past. The present period has been called the steel age, the horseless age, the age of speed, and numerous other "ages"; but perhaps the most characteristic name for it would be the *age of color*. Our present era demands color to an extent that no previous period has done.

Not many years ago every object made from iron and steel was supposed to be painted black. Today, machines and other devices made from metal are painted all kinds of colors. For some classes of equipment the colors have been standardized, like the machine tool gray for shop equipment. Thus paint has become an important consideration in the manufacture of machinery and metal products.

The Age of Color Gives New Value To Paint

Furthermore, paint no longer simply means a color and a finish. There are paints that resist the action of acids, alkalis, oils, and cutting fluids. There are others that serve as electrical insulators, and still others resist heat to a remarkable degree. Some resist hammer blows or severe bending and deformation of the painted object.

To aid the manufacturer of machinery and metal products in selecting the kind of paint best suited for the purpose which his product must serve, MACHINERY has prepared a comprehensive paint chart which is issued as a supplement to this number. This chart gives information that will prove of value in every manufacturing plant where metal products of any kind are finished by painting, either to improve the appearance or to provide protection for the metal.

A cartoon, intended to suggest how the unemployment problem might be relieved by the use of labor-increasing machinery, recently appeared in one of the New York dailies. The cartoonist pictured a 30-man radish puller, an 83-man peanut cracker, and a 5-man lawn mower. He merely intended to be funny; but after all, there is some food for serious thought in his expression "labor-increasing machinery."

Actually, there is a great deal of labor-increasing machinery in operation. Every old, obsolete machine that produces goods at a higher cost than up-to-date equipment is a labor-increasing machine. It wastes labor and human effort; and as the value of human effort can be expressed commercially only in dollars and cents, it wastes dollars and cents.

In almost every manufacturing plant throughout the country will be found some of these labor-increasing machines. It is poor business to continue to make use of them. They make it more difficult to compete with manufacturers using better machines and methods; they cause failures in business; and so, instead of helping to relieve the unemployment problem, they throw men out of employment.

Have You Any Labor-Increasing Machines In Your Shop?

They are very accurately described as labor-increasing machines, but they do not increase the returns of capital nor the wages of labor. If American industry as a whole would recognize the waste due to obsolete, labor-increasing machinery, we would enter upon an era of industrial activity that would eclipse any former period.

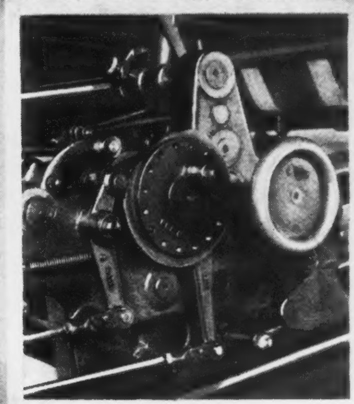
Even the most experienced designer needs to keep informed about the latest manufacturing equipment and practice, because economical production always begins in the drafting-room. The best designer is the man who is able to see his design in terms of the best method of manufacture. He keeps one eye on the drawing-board and the other on the shop. He designs machine parts to suit the most efficient means of producing them. He utilizes new developments in manufacturing practice which may, and often do, affect designing methods. As an example, note the revolutionary changes in machine design brought about by the application of electric and gas welding.

Designers Who Aid In Reducing Shop Costs

The designer's knowledge of shop practice has sometimes been the deciding factor in the success or failure of a company. In the early days of the automobile industry, the automobile designer cared little or nothing for production costs. As a result, he designed cars that could be built only to sell at a price too high for commercial success. What happened? Only a very few of the early automobile manufacturing concerns are still in business. Most of the others failed because they could not meet the reduced manufacturing costs of those companies whose designers understood manufacturing problems and how to reduce prices.

It is not enough to know how to design a machine that functions; it must be possible to build it at a reasonable cost.

Ingenious Mechanical Movements

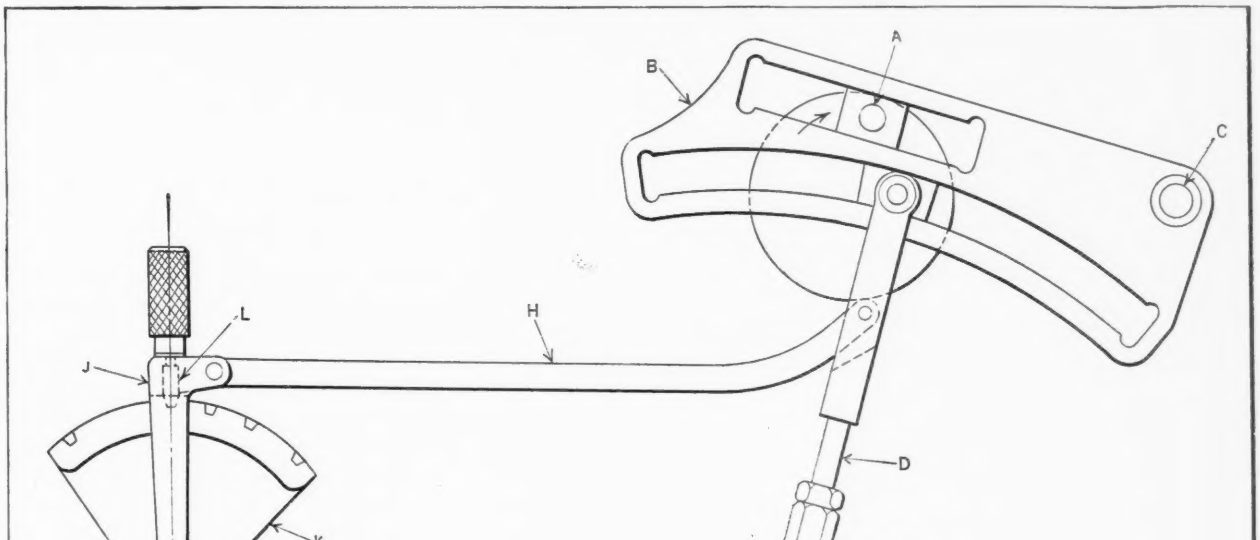


Ratchet Feed with Link Motion Adjustment

By H. E. KITCHEN

The ratchet and pawl feed shown in the illustration was designed to fulfill the following conditions: (1) The rate of feed must be changeable without stopping the machine; (2) the pawl must always terminate the feeding stroke in the same angular position; (3) after making four complete revolutions, the feeding movement must cease for an interval and the pawl must always engage the same notch on the final movement.

The feeding movement is derived from the crankpin *A*, which imparts a non-varying angular reciprocating movement to plate *B* about the fulcrum stud *C*. By having the crankpin *A* rotate in the direction shown by the arrow, a quick-return motion is obtained for the pawl. The link *D* transmits the movement to pawl lever *E*, and pawl *F* transmits the feed to ratchet wheel *G*.



Design of Ratchet Feed Mechanism with Link Motion Adjustment

The swinging link H is connected to the link D and the anchor lever J, which can be swiveled to various positions along the segment K by withdrawing the spring plunger L. The operator can easily adjust this member on the return stroke of the pawl F when the parts are not under a load. Adjustment of lever J causes the upper end of link D to slide along the lower slot in plate B. Thus by locating the upper end of lever D either nearer or farther from the fulcrum C, a shorter or longer movement of the pawl F may be obtained, as desired.

The lower slot in plate B is formed to a radius of the same length as link D. Thus, when plate B is in the highest position, as shown in the illustration, the center e of the arc-shaped slot will always be in the same place. It will be seen that when the motion is arrested in the position shown, the upper end of link D can be traversed the whole length of the lower slot without imparting any movement to the pawl F. The turnbuckle M provides the adjustment required for locating the point e accurately.

The ratchet wheel G is given a rather unusual form in order to meet the third requirement. The number of indexing movements per cycle ranges from 20 to 36, and as four revolutions of the ratchet wheel are completed per cycle, we have $20 \div 4 = 5$ notches and $36 \div 4 = 9$ notches. The number of notches required for the different numbers of indexing movements within this range are obtained in the same manner. The essential feature is that the first notch for all feeding movements shall be located at g.

With this ratchet feed, it is obvious that the coarsest feed will require a minimum angular movement of pawl F, equivalent to $360 \div 5 = 72$ degrees, and that the finest feed will require an angular movement of $360 \div 9 = 40$ degrees. The notches nearest notch g, that is, g_1 and g_2, are located 40 degrees each side of point g, or 80 degrees apart.

Now, if the anchor lever J is moved during the running period to increase the feed to the maximum amount, the first one or two movements following the change may be erratic and the pawl may fall short of the required movement; but even if it happens to engage notch g_1, which rightly belongs to the 40-degree feed or the 36-movement indexing cycle, a swing of 72 degrees plus, say, 3 degrees for clearance, will be insufficient to engage the tooth at g_2, which, as previously stated, is 80 degrees from g_1. Thus no movement of ratchet G will occur during the next feeding stroke, and there will be no indexing movement until pawl F advances to and engages the correct notch g. Ratchet G will then be rotated until notch g reaches the correct finishing point.

From the preceding description it will be obvious that the coarsest feed must be slightly less than twice the finest feed in order to insure proper functioning. Thus, if we let S equal the smallest number of divisions and G the greatest, then G must equal $2S - 1$. In the case described, $S = 5$; therefore, $G = 9$. If $S = 8$, $G = 15$.

Theoretically, we could then use all the numbers from 9 to 14, inclusive. In practice, however, some of these divisions would interfere, but this trouble could be avoided by having two ratchets mounted side by side with the divisions split up between them and the zero notches on both ratchets in alignment. Individual pawls, would, of course, be necessary. If a slight irregularity in feed is not objectionable, one ratchet could be used, employing the maximum number of equally spaced notches consistent with strength, but with the spaces from g_1 to g and g to g_2 left blank. Each of these spaces would equal $360 \div 15 = 24$ degrees.

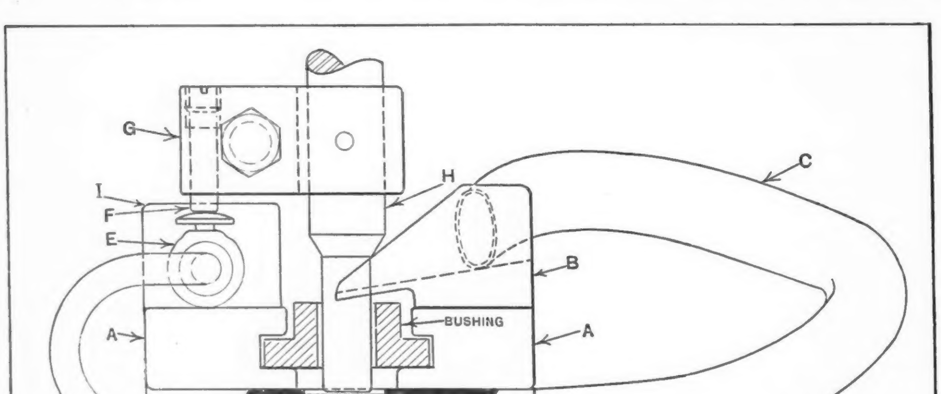
* * *

Returning Burnishing Ball Pneumatically

By J. E. FENNO

In the illustration is shown a simple method of burnishing the bore of flanged bushings automatically in a power press through the medium of a ball. The bushings are fed into an inclined chute, the lower end of which is shown at A. They descend by gravity, the first one coming into contact with a stop (not shown), so that it is located directly under the push-rod H. The stop is of the latch type and is released on the upward stroke of the press to allow the bushing to be ejected. In the position shown, the ball has just passed through a bushing and into the tube C.

Just before the ram has completed its downward stroke, the screw pin F in the arm G comes in contact with the button on the air valve E. A further



Burnishing Fixture in which Ball is Returned by a Blast of Air

downward movement of the push-rod causes the screw pin to depress the button, opening the valve E enough to allow a blast of air to pass through the tube D and against the ball. The force of the air pushes the ball up the tube C, depositing it on the chute B.

The ram now begins to ascend and when the bottom of the push-rod has cleared the top of the bushing, the latter, through the pressure of the other bushings in the chute, is ejected from the fixture. When the push-rod has reached the top of its stroke, the ball drops into position ready to be pushed through the next bushing. This completes one cycle of operations.

To regulate the pressure of air passing through the air valve E, the screw pin F is adjusted and clamped securely by means of a cap-screw in the arm G, the latter being split to provide the necessary clamping action.

* * *

Straight-line Mechanism for Gang Saw

By ROBERT F. MOORE

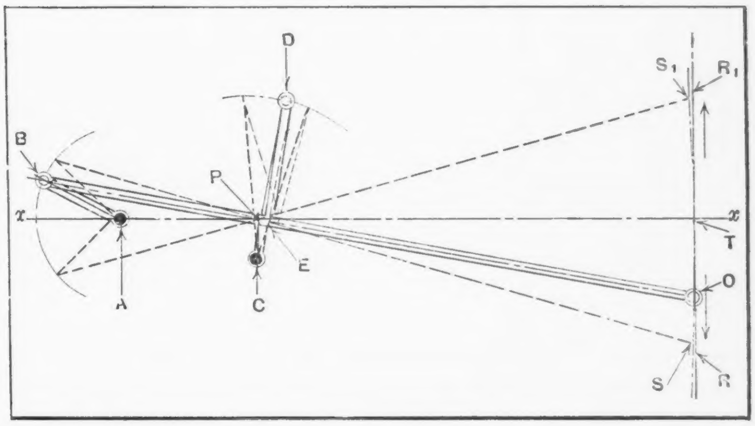


Diagram of Straight-line Mechanism Used on Granite Gang Saw

The mechanical movement shown in the accompanying diagram is used in connection with a gang saw for sawing granite, to obtain an approximate straight-line motion with a combination of links. The bearings or pivots A and C are stationary. Link AB is free to turn about bearing A, and CD is free to turn about bearing C. The rigid bar or link OB has an extension ED at right angles to it, which is pivoted at D to the lever CD. As the end O is moved in the direction of the arrows, the pivot B swings about an arc having a radius AB, and the pivot D swings about an arc CD. The resultant movement of the point O is very nearly a straight line.

When this mechanism is applied to a granite gang saw, a slight rise at the ends of the stroke S and S_1 is required, so that links of special length are used. These lengths, in inches, are as follows: $AB = 8\ 1/2$; $OB = 66\ 1/2$; $EB = 22\ 13/16$; $AP = 13\ 1/2$; $CD = 16$; $ED = 12$; $RT = 12$; $R_1T = 12$. The rise at the end of the stroke is 1/4 inch, approximately.

Four mechanisms of this type are used on the granite gang saw. Each mechanism is so located that the center line x–x is vertical, the straight-line movement being horizontal. The machine is equipped with a rectangular "sash" in which there are numerous steel blades. Each corner of this sash is attached to one of these straight-line movements, and the sash is moved back and forth by a crank and connecting-rod. Steel-shot under the blades works against the stone and does the cutting at the rate of from 3 to 6 inches per hour. The object of the slight rise at the ends of the stroke is to allow the grains of shot to fall under the blades as the shot drops down from above. By shortening the dimensions AB and EB equally, the end O can be made to travel in an exact straight line for a certain distance.

* * *

A New Idea in Mechanical Training

The American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill., in cooperation with the Lewis Institute of Chicago, has developed a method for training young men in machine shop practice that will enable employers to obtain young men having good training without incurring the expense of organizing a complete apprentice training course.

Those entering the course must have graduated from high school or have acquired a good general education by other means. A period of industrial experience may offset the requirement for a complete high school course. The young man then receives adequate instruction both in machine shop work and engineering subjects for two years, after which he completes one year of satisfactory service in one of the shops affiliated with the American Machinery and Tools Institute.

Upon the completion of this course, he will have finished the equivalent of two years of college work in engineering, and at the same time he will have been trained to become a skilled workman in the machinery and tool industry. Further information about this new method of industrial training will be furnished, upon request, by George R. Tuthill, Executive Secretary, American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill.

* * *

We hear so much about the "key man" and his part in preventing accidents, waste, and all other industrial ills. Much of it is just plain "passing the buck." Safety develops in the plant only so far as the manager desires it. The foremen can do little if the boss doesn't lead the way, set the example, and stand back of his foremen. I have known many a foreman whose hands were tied because of indifference and neglect higher up. *John S. Shaw, in "National Safety News"*

Fixture for Planing Boxes for Cross-head Pins

By CHARLES C. TOMNEY, Chief Tool Designer, Brunswick-Kroeschell Co.

THE two upper views in Fig. 1 show the cross-head pin boxes used on a 3 1/4- by 4-inch steam engine. The fixture employed in planing the sides *B* of the boxes is shown in Fig. 2. The boxes are made of tough bronze, and before making the fixture illustrated, the sides were milled in gangs of five pieces on a special arbor held between the centers of a dividing head. This method was unsatisfactory, however, as the end milling cutter employed would not stand up satisfactorily, and when the cutter became dull, a concave surface was produced due to the springing of the arbor. This involved an added expense for hand-finishing. Although only about 500 boxes of several different sizes are made per year, the fixture to be described has proved a good investment. All the different sizes of boxes have one side tapered to the same angle and are planed on the fixture illustrated.

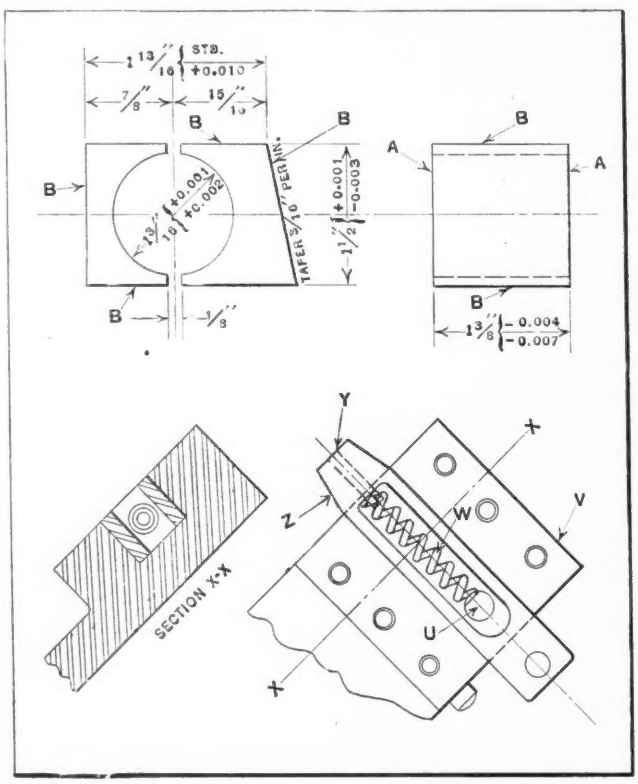


Fig. 1. Details of Box for Cross-head Pin, and Section of Indexing Fixture

The floor-to-floor time per box, machined in lots of thirty, planing five at one setting, is fifteen minutes. Four operations are required to make the boxes. These are: Bore and ream; face surfaces *A*, Fig. 1, with the work mounted on an arbor in an engine lathe; plane surfaces *B;* and split the boxes on a hand milling machine.

At *C*, Fig. 2, is a hardened steel templet 0.010 inch smaller on all sides than the smallest cross-head pin box. This templet is hardened and ground all over; it is forced on the spindle *D* and held in place by a taper pin. The templet bears against the shoulder *E*, which is machined integral with spindle *D*. A washer *F* is placed between the templet and the bearing *G* of the fixture.

The shoulder *E* takes the clamping strain, so that there will be no shearing action on the tapered pin when the nut *H* is tightened. The index-plate *I* is fastened to spindle *D* by a taper pin *J*. Three of the notches in the index-plate are spaced 90 degrees apart, and the fourth notch, which is shown with the index-pin inserted, is offset at an angle to correspond with the taper of the box. In this case, the side of the box has a taper of 3/16 inch per inch, which corresponds to an angle of 10 degrees 42 minutes 42 seconds. If the arbor of the fixture should become strained or distorted as a result of the clamping action, it is an easy matter to realign the index-plate with the templet by grinding one side of the notch as required.

The fixture is designed to hold five boxes of the size illustrated. For some of the larger sizes, only two boxes can be accommodated. As the templet *C* is made 0.010 inch under size, a 0.010-inch feeler gage is used for setting the tool used in taking the finishing cut. Only a roughing and a finishing cut are required. Gages of different thicknesses are used in setting the tool for planing the larger sized boxes. Three different feeler gages are necessary for each size. Bushings are provided for mounting the larger sizes on the spindle *D* of the fixture.

The square end *K* of spindle *D* is lined up with the index-plate so that when the index-pin is withdrawn from the notch and the spindle turned to bring the end *K* square with the shaper table, the index-pin will rest on the periphery of the index-plate. The steel plate *L* is slotted at *M* to give a close fit on the squared end of the spindle. When the squared end *K* of the spindle is in slot *M*, the lower edge *N* of plate *L* rests on the shaper table. Plate *L* is inserted between the squared end of the spindle and the shaper table when tightening or loosening nut *H* for loading or unloading. This eliminates all strain on the index-pin. Plate *L* is also used for indexing the work instead of employing a wrench.

The steel collar O is made 0.010 inch smaller in diameter than the dimension across the sides of the smallest box in order to give sufficient clearance for the planing tool. The end of the spindle is turned down to a diameter of 7/8 inch and is fitted into the tailstock P. The tailstock has a tongue Q held in place by a small screw which fits into a groove in the base R. This construction prevents the possibility of the spindle being forced out of line as a result of the strain set up by the planing tool. The tailstock is held in place by a nut and the stud S. The base of the tailstock is slotted at T so that it can be readily withdrawn when the nut on stud S is loosened.

It is unnecessary to have a tongue in the body of the fixture, as the sides only need to be planed parallel with the shaper table. A detail of the indexing mechanism is shown in the lower view of Fig. 1. A pin U is driven into the steel plate, and a flat is cut on this pin which furnishes a seat for the coil spring W. The indexing pin Z is slotted through, as shown by section X–X, to receive the coil spring W. A pin Y driven into the end of the indexing pin serves as a pilot for the coil spring.

* * *

While we generally think of the automobile industry as being concentrated in a few large centers, it is of interest to note how widespread are the sources from which this industry draws its raw materials and its parts. Every state in the Union produces some raw material used in automobile manufacture or operation, and thirty-three states manufacture parts used in the automobile industry. There are over 100,000 repair shops and service stations, and 54,000 retail automobile dealers.

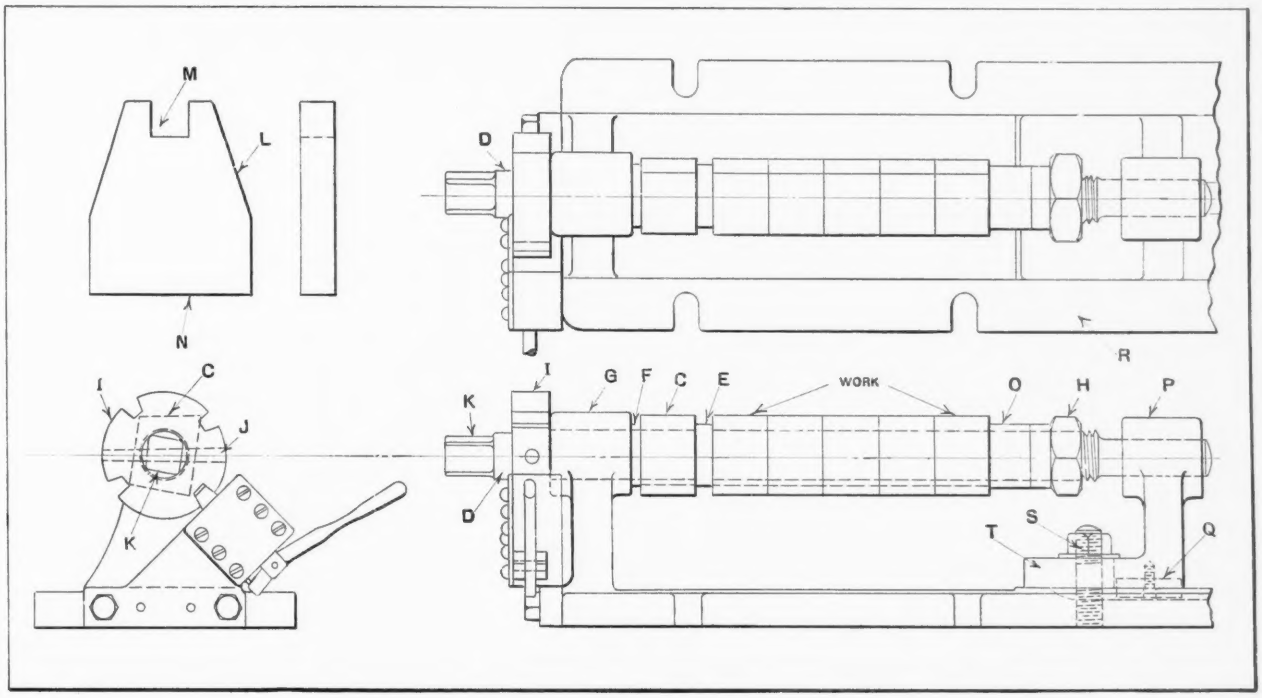


Fig. 2. Indexing Fixture Used in Planing Sides of Cross-head Pin Boxes

The Brighter Side of the Business Situation

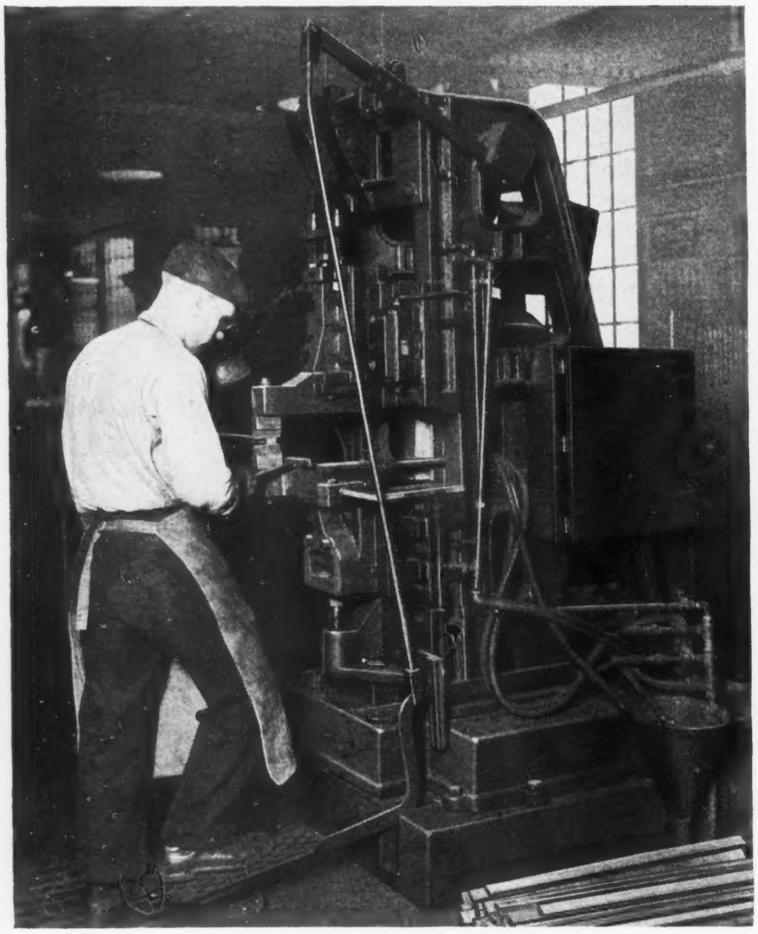
Gains in automobile production continued through April, according to the National Automobile Chamber of Commerce. Estimates based on shipping reports placed the production of the industry for the month at 348,909 cars and trucks, which represents an increase of 21 per cent over the March output. This is the fifth consecutive month during which there has been an increase in automobile production. The output for the first four months of 1931 was about 1,046,400 cars and trucks.

Arthur J. Tuscany, manager of the Gray Iron Institute, Inc., states that March was the third consecutive month in the gray iron industry showing an increase in business over the preceding month. The greatest activity was evidenced in the middle-western and the southern territories. Every district, however, reports an increase.

* * *

A New Idea in Salesmen's Meetings

The Black & Decker Mfg. Co., Towson, Md., has made plans for a salesmen's meeting that will combine business with recreation. Certain salesmen in each of the Black & Decker jobbers' organizations will spend a week at Atlantic City at the company's expense as a reward for work well done. Meetings will be held in the morning of each day at the Black & Decker permanent exhibit on the boardwalk. The rest of the day is intended for recreation. The week set aside for this purpose is from August 30 to September 5.



Using an Electric Brazing Machine and Self-fluxing Alloy that Thoroughly Fluxes the Joint, Thus Simplifying the Process and Producing a Better Joint

Brazing with a Self-fluxing Alloy

By C. J. SNYDER

SIGNIFICANT in the art of brazing and welding is a new technique in the process of joining parts made of copper or copper-base alloys. This process has been greatly simplified by a self-fluxing phosphor-copper alloy which is available in wire and strip form. In welding, however, this alloy has a very limited use, as it is usually applied only to joints in straight wire or small strap. When applied in this way, the wires or strap are butted together under pressure and a sufficient amount of electricity is discharged through the joint to fuse the ends.

The alloy is composed essentially of copper and phosphorus, the copper forming the alloy base and the phosphorus acting as a flux. The effectiveness of this element as a flux for joining copper has been found by experience to equal that of any prepared chemical flux so far tried.

In the phosphor-copper alloy, the phosphorus is uniformly distributed, thus assuring effective fluxing at any point touched by the molten alloy. Because no additions of flux are necessary while brazing or welding, the process is greatly simplified as mentioned, and in addition, joints can be made in inaccessible places that otherwise would be impossible to reach. A further advantage is that joints can be made adjacent to insulating material or in parts that are to be painted later without leaving an undesirable flux residue. This is particularly desirable in brazing exposed electric terminals.

Previous to the use of the phosphor-copper alloy, joints in copper were welded or else brazed with spelter or perhaps silver solder. Spelters are cheap, but require a relatively high brazing temperature and the addition of a flux. Silver solders are expensive, but they flow at a lower temperature and require a flux. The phosphor-copper alloy is relatively inexpensive, works at a comparatively low temperature, and does not require a flux.

Procedure in Making the Joints

The process of brazing with phosphor-copper varies somewhat with the application. In all cases, the places to be joined should be clean and free from grease. When possible, the members of the joint should be clamped together. After a piece of phosphor-copper strip has been inserted between the mating surfaces, the joint is heated as rapidly as possible to a temperature of about 800 degrees C. At this temperature, the alloy will fuse, and if necessary more phosphor-copper may be added, after which the edges of the joint may be given a nice appearance by touching a phosphor-copper wire along them.

If the joint is held at the brazing temperature for an appreciable length of time—for instance, five minutes—the phosphor-copper may appear to be sluggish and may be condemned because it will not flow. However, the reason for this is that excessive heating has caused a loss of some of the phosphorus flux and thus has raised the melting point of the alloy. If reheating or if longer heating is necessary, more brazing alloy must be added. On the other hand, if insufficient heat is applied, the joints will have a tendency to be brittle.

Examples of Machine Brazing with the New Alloy

In the heading illustration is shown an electric brazing machine used at the East Pittsburgh Plant of the Westinghouse Electric & Mfg. Co. The workman is adjusting two copper parts clamped in the jaws of the machine. The jaws are fitted with carbon blocks which become incandescent when heavy electric currents are passed through them, and thus supply heat to the joint. A wide variety of work can be handled on this machine by using jaws of suitable size and shape.

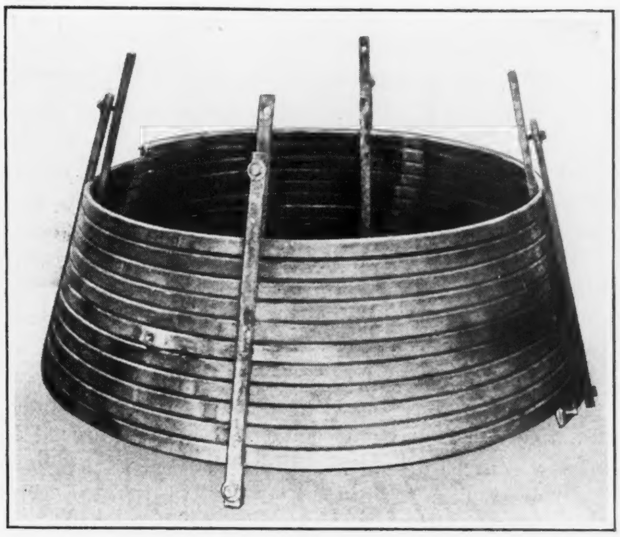


Fig. 1. Coil 190 Feet Long Made from Tube Sections Brazed Together with the New Alloy in the Machine Shown in the Heading Illustration

This machine is employed for making the 190-foot cooling coil shown in Fig. 1. The coil is made by brazing together twenty-six straight lengths of copper tubing having an inside diameter of 1 inch and an outside diameter of 1 1/2 inches. After being brazed, the tube is drawn flat and coiled.

Fig. 2 shows a number of small copper connectors brazed on the same machine. A portable machine, operating on the same principle as the large one, has also been developed by this company, and has been found advantageous for brazing motor coil connections with the new alloy.

Machines of this type could be designed for almost any brazing service by varying the size and design of the jaws, and with some modification, could be adapted for either automatic or manual operation.

Torch or Electric Arc Heating is Better Adapted for Some Classes of Work

When neither of the machines mentioned can be applied to the job in hand, a welding torch or an electric arc can be used for heating. The surfaces to be joined should be clean and mechanically well fitted together. Some work, such as welding a header to the tubes of a radiator, is best suited for torch heating, whereas such work as welding the seams in boilers and tanks can be more quickly done by using the arc made by carbon electrodes.

In using a torch, the process is precisely the same as that previously described; that is, when possible, a strip of the phosphor-copper is inserted in the joint before heating, and the joint is brought up quickly to full brazing temperature. Additional brazing alloy can be applied while the joint is at this temperature. When a strip of alloy cannot be inserted in the joint, satisfactory results can be obtained by heating the joint and flowing the alloy into place.

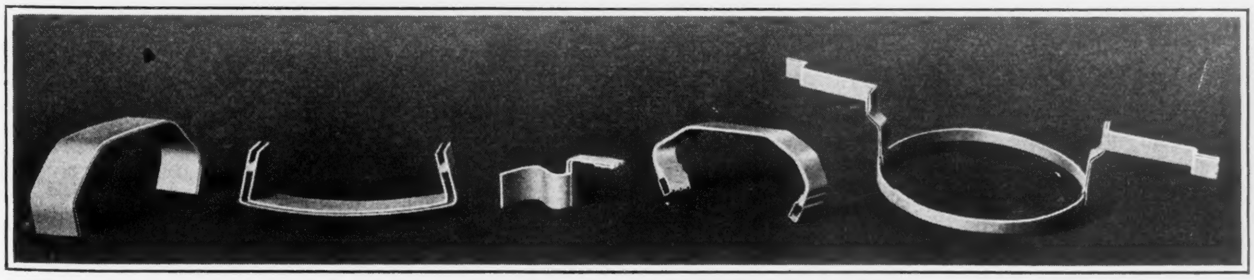
Alloy in wire form should be used for this purpose, because it flows more freely than the strip. Also, the work will be greatly facilitated if the brazing alloy is first applied to the joint at the lowest temperature at which it will melt, after which the joint should be heated to the usual temperature of from 800 to 835 degrees C.

In using an electric arc for welding with phosphor-copper, the best results are obtained by using a carbon electrode, and not the wire itself, for drawing the arc. This is true because the phosphor-copper wire melts at such a low temperature, when used as an electrode, that it melts down before sufficient heat is produced to "burn it in." A steel backing plate clamped on the inside of the joint will aid in preventing the phosphor-copper from running through the joint.

Method of Making Different Types of Joints

The joints may be mechanically well fitted, as previously described, or they may have their edges beveled at angles of from 45 to 60 degrees with the horizontal. When possible, however, the joints should be mechanically fitted, partic-

Fig. 2. Some Copper Connections also Brazed with New Alloy on Machine Shown in Heading Illustration



ularly butt joints for boilers in which the plates have square, close fitting edges; but more time and care will be needed for making this joint than for making the conventional scarf joint.

For butt joints, phosphor-copper wire should be used as a filler rod and the melted alloy puddled into the joint with the arc. Sufficient heat should be applied to fuse the outer edges of the plates along the seam and to insure that the phosphor-copper has penetrated the entire depth of the joint.

There are applications where joints must be made quickly and with the lowest amount of heat possible to avoid a heat flow to other parts of the apparatus being constructed. Joints in copper bars adjacent to electrical insulation are illustrative of such applications. In such cases, a scarf joint is a great advantage, because a heavy bead can be laid in the V-groove quickly and in one pass, the only precaution necessary being to see that sufficient heat is applied to insure penetration of the phosphor-copper into the pieces being welded.

A Heavy Deposit of Alloy will Make the Joint Brittle

There will be some variation in the results obtained with the methods just described. When heavy deposits of phosphor-copper are required, it is very difficult to create a large enough loss of phosphorus to make the deposit tough without being brittle. As this loss of phosphorus is brought about by oxidation from the air and penetration into the surrounding metal, it will be readily understood that a fitted joint containing a thin deposit of welding alloy will have greater toughness and ductility than one containing a filled V-groove.

Sample welds in soft sheet copper, 3/16 inch thick, have been made by making mechanically fitted butt joints. These joints were strong and ductile enough to bend 180 degrees on a 3/16-inch radius without cracking on the outside of the bent portion.

Classes of Work for which Alloy is Adapted

The methods described for joining copper with phosphor-copper alloy have been found especially advantageous in making heavy-duty radiators, cooling coils, and electrical connections, and in making joints that were formerly riveted, soldered, or brazed by the old method. Strong, tough joints that withstand vibration and are impervious to air, oil, and water are secured. Of course, a certain amount of experience is necessary before the best results can be expected, although satisfactory results can be obtained with little practice.

* * *

Soft rubber can be cut more easily and smoothly with a knife if the blade is dipped in cold water. Smooth and true holes can be drilled in soft rubber with a drill made similar to a dinking punch, except that the bore must extend the entire length of the tool, which is used in a drill press, employing water as a lubricant.

Economy in a Blueprinting Room

By JULIUS A. KLOSTERMANN, Chicago, Ill.

It occurs to the writer after reading the article "Blueprinting Room Planned for Economy," published on page 516 of March MACHINERY, that even greater economy could be obtained with the latest type of blueprinting equipment. This economy would be effected through higher production with lower labor cost.

For example, by using a modern printing machine, in conjunction with a vertical sheet washer and a drum sheet dryer, one operator can print, wash, and dry 800 sheets, 12 by 18 inches, in from six to seven hours. In an eight-hour day, this allows at least one hour for cleaning up and delivering the prints. At this rate, the monthly output will be about 24 $\times$ 800 = 19,200 sheets with only one operator. The equipment, costing about $1000, would be paid for by the saving in labor alone in a period of about a year.

Vertical sheet washers are preferable to the horizontal type, because the number of operations are limited, smaller floor space is required, and the economy in the use of water and potassium is greater. Wet floors resulting from the dripping water are also avoided.

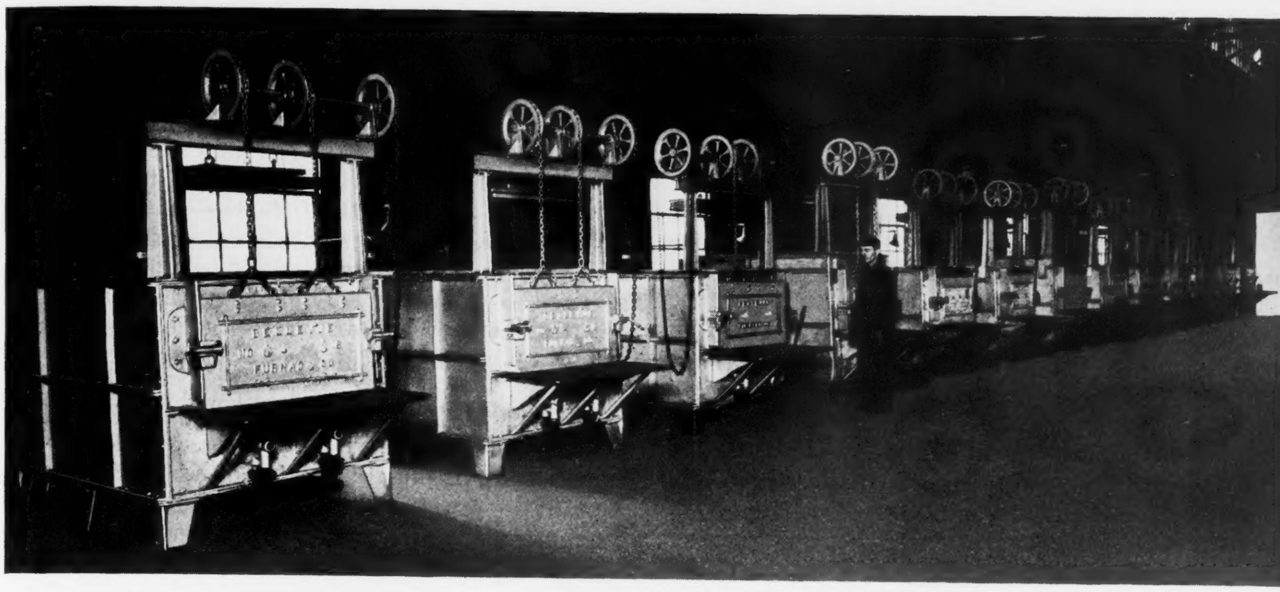
Even greater production than that mentioned can be obtained if continuous blueprinting, washing and drying equipment is used. For instance, a well-known firm, equipped with one continuous machine, produces, with two operators, 3000 prints, 12 by 18 inches, per day. Ordinarily, one operator produces 13,000 of these prints in a month, devoting four hours a day to this work. In this way, the operator may be released to attend to other duties during the remainder of the day. For this reason, many firms find it more economical to operate the continuous equipment.

* * *

National Foreign Trade Convention

The eighteenth National Foreign Trade Convention was held at the Hotel Commodore, New York City, May 27 to 29. Almost every phase of export trade was dealt with in the numerous papers presented before the convention. Special attention was given to the present European situation and to our trade relations with Latin America. One session was devoted to export advertising, at which a paper was read by Wallace Thompson, editor of *Ingenieria Internacional*, on the subject "The Effect of Present Economic Trends Abroad upon Advertising Policy."

An interesting feature of the convention was the trade advisory service that was made available to the delegates. With the cooperation of the State Department and the Bureau of Foreign and Domestic Commerce, a joint service was arranged, so that any delegate to the convention might consult with specially trained men in regard to his own individual export problems. This service was an extension of similar aid given at former meetings.



How a Modern Shop in the South Heat-treats Oil-well Drilling Tools

Many of the 200,000 Different Parts Manufactured in a Large Southern Plant Require Special Heat-treatment and Equipment

By J. B. NEALEY

EFFICIENCY in the heat-treating of steel has become one of the most important factors affecting economy in the machine and small tool industry. Owing to the rapid strides made in this branch of the industry, the equipment, as well as the methods employed, has met with constant changes. Probably this fact is nowhere better illustrated than in one large plant in the South, which operates one of the most modern heat-treating departments in the country. This concern—the Guiberson Corporation, Dallas, Tex.—manufactures oil-well drilling equipment of such a diversified nature that over 200,000 different parts are produced.

Many of these parts are made from forgings weighing up to two tons and require heat-treatment of a special nature in order to withstand the great amount of abuse to which they are subjected.

In the heading illustration is shown the furnace room, along one wall of which may be seen a battery of thirteen large gas furnaces of the latest design. Each furnace is equipped with an automatic temperature control and a pyrometer to insure uniformity in the heat-treatment. Eleven of these furnaces are of the semi-muffle type and the remainder are of the muffle type. They are 4 feet wide, 6 feet long, and 18 inches high inside, and have a capacity for handling a great variety of work.

The parts to be heat-treated are delivered to the furnace on skids by an overhead traveling crane. To conserve floor space, the gas and air manifolds, each 12 inches in diameter, are located outside of the building and run along the entire length of the wall adjacent to the furnaces. Leaders conduct the gas and air through the wall to the furnaces.

Fig. 1. Quenching Tanks are Located below the Floor Level to Conserve Floor Space and Facilitate the Quenching Operation

In order to equalize the pressure of the mixed gas when only a few furnaces are in operation, each end of the air manifold is equipped with an escape valve which releases the air when a predetermined pressure has been reached. The furnaces are provided with air by the three motor-blower units shown in Fig. 2. Ordinarily, however, two of these blowers provide the required amount of air, the third serving only in case of a breakdown of one of the other two.

In the center of the furnace room are located two steel quenching tanks, one of which is shown in operation in Fig. 1. These tanks are used for large work, and their tops are below the floor level. When not in use, they are covered by a steel plate flush with the floor. It is obvious that with this arrangement floor space is conserved. The oil in these tanks is kept at a uniform quenching temperature by pumping it through coils in a tank 3 feet in diameter and 10 feet high located outside of the building.

For hardening small high-speed steel tools, a unit group consisting of a small preheating furnace, a cyanide furnace, and a high-temperature furnace is provided. There are, in addition, two steel tanks heated by gas burners for oil tempering these tools.

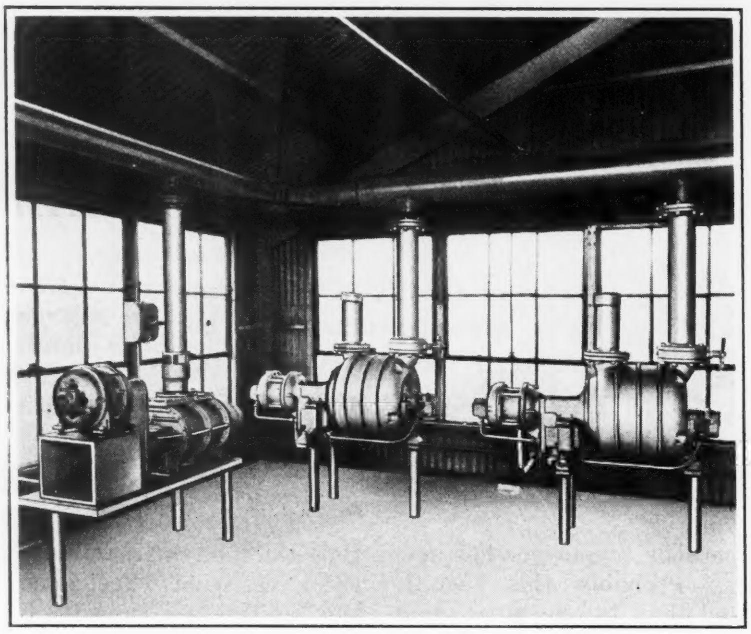


Fig. 2. Only Two of These Blowers are Needed to Provide Air for the Furnaces. The Other is Used in Case of Emergency

The principal product made by this company is a rotary bit for drilling oil wells. This bit is shown in Fig. 1 being quenched. It weighs about two tons and is made from a forging of S.A.E. 3250 steel containing 0.54 to 0.55 per cent carbon, 0.30 to 0.60 per cent manganese, 1.50 to 2.00 per cent nickel, 0.90 to 1.25 per cent chromium, 0.04 per cent phosphorus, and 0.04 per cent sulphur.

Normalizing and Hardening a Forging Weighing Two Tons

A good deal of machining is required on these bits, but before this is done, they must be normalized—that is, the internal stresses resulting from the forging operation must be relieved; otherwise, warping might occur while the bit is in use. In normalizing, the forging is first heated to a temperature of 1750 degrees F. in one of the furnaces shown in the heading illustration. Then the gas is shut off and the bit is allowed to cool slowly, after which it is reheated to a temperature of from 1250 to 1300 degrees, and again allowed to cool slowly.

The internal stresses being relieved, the bit is now removed from the furnace and the machining operations are performed. Following this, the bit is once more placed in the furnace—this time to be hardened. After being heated to a temperature of from 1400 to 1450 degrees F., it is quenched in a tank as shown in Fig. 1. Following the quenching, it is again heated and drawn to the required hardness, after which it is given its final quenching.

Obtaining Extreme Hardness and Toughness in Cutters

The cutters for these bits are forged integral with a small shaft or plug which fits into the end of the bit. Both plug and cutter are made of S.A.E. 4615 steel containing 0.10 to 0.20 per cent carbon, 0.30 to 0.60 per cent manganese, 0.04 per cent phosphorus, 0.045 per cent sulphur, 1.50 to 2.00 per cent nickel, and 0.20 to 0.30 per cent molybdenum.

Owing to the abrasive quality and the snagging action of the material to be drilled, the edges of these cutters must have an unusual degree of hardness and toughness. This is obtained chiefly by carburization in furnaces of the semi-muffle type, as illustrated in Fig. 3.

The cutters are packed in cylindrical boxes with a carburizing compound, the packing being done on a special apron protruding from the opening in the furnace. To further facilitate charging the boxes, a two-wheel dolly is provided. After charging, the doors are "luted" and the burners lighted. It requires from fourteen to twenty hours to bring the temperature of the bits up to 1650 degrees F. This temperature is maintained for about twenty-four hours and then the burners are turned off to allow the charge to cool to a temperature under 300 degrees F. The time required for proper cooling varies from twelve to twenty-four hours, depending upon the character of the carburizing compound used.

After cooling, the cutters are removed from the boxes and placed in the muffle furnaces, which at this time have a temperature of from 900 to 1000

degrees F. Both furnace and cutters are then raised to a temperature of 1525 degrees F., the time required for this being about 1 1/2 hours. This temperature is held for a period equivalent to one hour for each square inch of cross-section of one of the cutters in order to obtain a uniform heat. The cutters are then quenched in oil and reheated to 1425 degrees F. After maintaining this temperature for the period just mentioned, they are quenched in oil having a temperature of 300 degrees F. The cutters are left in the quenching bath for five hours, after which they are transferred to a tank of boiling water to clean off the oil and also to remove any slight internal stresses that may exist. A case 0.087 inch deep, with a hardness of 68C Rockwell, is obtained by this treatment.

In heat-treating cutters of the under-reamer type, no pack-hardening is required, as they are made from a special high-carbon steel. The composition of this steel is as follows: Carbon, 0.70 per cent; nickel, 3.50 per cent; chromium, 1.25 per cent; vanadium, 0.18 per cent. These cutters are charged directly into a furnace heated to 1000 degrees F., and then raised to 1450 degrees F. After being held at this heat for a specified time, they are quenched in oil having a temperature of from 300 to 350 degrees F. They are then returned to the furnace and reheated to 1000 degrees F., drawn for two hours at this temperature, and then air-cooled, producing a scleroscope hardness of from 75 to 80.

Fig. 3. To Facilitate Operating this Furnace, a Two-wheel Dolly is Used for Charging and Removing the Carburizing Box

Local Hardening of Part Having Sections 1/32 Inch Thick

Among the many products manufactured by this company is a cylindrical head for a Diesel aircraft engine. It is made of alloy steel and is drop-forged to a diameter of 4 1/2 inches and a length of 12 inches. This alloy steel consists of 3.50 per cent nickel, 1.25 per cent chromium, 0.28 per cent molybdenum, 0.18 per cent vanadium, and 0.60 to 0.80 per cent manganese.

The wall thickness of this head is 3/32 inch, while the cooling fins are only 1/32 inch thick. Consequently, in heat-treating, unusual care must be exercised in order to prevent uneven stresses which might result in disaster while the head is in use. It is necessary, therefore, to devise some means of quenching this part so that the bore will be very hard and the fins comparatively soft.

To meet these requirements, the head is put into a muffle furnace having a temperature slightly under 1000 degrees F. The temperature is then raised to 1390 degrees F., after which the head is quenched in oil by means of a special bell-mouthed fixture. The outside of this fixture is small enough to enter the bore in the head, and immediately after the head has been removed from the furnace, the fixture is thrust into the bore of the head and clamped into place, the whole being suspended above the floor. From an overhead reservoir, oil is pumped through an opening in the top of the cylinder. It requires approximately two barrels of oil running steadily through the cylinder to chill the bore. Thus although the heat is also drawn from the fins, the rate of withdrawal is so slow that the fins are left comparatively soft.

* * *

In the May 15 number of *Looking Ahead*—a publication issued by Alvan T. Simonds, president of the Simonds Saw & Steel Co., Fitchburg, Mass.—it is pointed out that even a brief study of business cycles and the relation of depressions to increasing money rates seems to prove that if money rates are prevented from increasing progressively for two or three short business cycles, or from going to an extreme high in any one cycle, the severity of the cyclical business depressions will diminish. Certainly, increasing money rates warn of a coming depression and give an idea of how severe it is likely to be. Now the question may be asked: "Could we, by adopting proper measures, entirely prevent this increase, and if so, would we thereby eliminate the detrimental effects of the present business cycles?" This question probably cannot be answered until we have learned more about the economics of business than we know now, but it points the way to further research.

The Economy of Correct Lubrication

Many Machine Shops Use Inferior Lubricating Oils, and as a Result Increase the Cost of Lubrication, Power and Maintenance

By The Technical Department
Vacuum Oil Co., New York

HIGH-GRADE lubricating oils are seldom used in machine shops for the lubrication of machine tools and other shop equipment. The reason for this is that fair lubrication can be obtained with ordinary oils. There are no such exacting requirements in the case of oils for this class or machinery as there are in the lubrication of steam turbines or Diesel engines; in other words, an unsuitable oil will not necessarily cause a serious breakdown that would be little short of a disaster. The inability of an oil to provide adequate lubrication is, therefore, not so readily apparent in a machine shop as in a power plant or in the engine room of a ship at sea.

Nevertheless, it has been demonstrated in actual service that high-grade lubricating oils are more economical in ultimate cost than inferior oils. Through the use of the best oil for any given purpose, economically applied, it has been possible to reduce the lubricant cost materially, as well as the expense for repairs and maintenance, the oiling labor cost, and the cost of power. In many instances, also, the productive capacity of shop equipment has been increased.

The present article has been prepared with a view to placing on record a number of concrete cases where one or more of these advantages have been obtained. The lowered costs resulting from correct lubrication are, in most instances, far in excess of the difference in cost between high-grade and ordinary oils, and in a large number of cases, are larger than the total oil bill itself. Therefore, the saving of a few cents per gallon in the first cost of oil is not the major consideration.

The equipment found in machine shops may be divided, roughly, into three classes: Delicate precision machines, regular machine tools, and heavy presses, shears, and forging machines. Research into the characteristics of oils and the requirements of lubrication has made it possible to recommend an oil of the right body and type to suit each of these groups. The methods of application—that is, the oiling devices—must also be adapted to each class of machine in order to insure economical use of the lubricant.

It has been proved in actual service that high-grade oils produce so much more effective lubrication than inferior oils that they are more economical to use in the long run. Through the use of the best oil for any given purpose, economically applied, it has been possible not only to reduce materially the cost of the lubricant itself, but to reduce the expense for repairs and maintenance, for oiling labor, and for power as well. In many instances, also, the productive capacity of shop equipment has been increased. The present article records a number of cases where definite advantages have been obtained from the use of high-grade lubricating oil, properly applied. In many cases, the savings have been larger than the total bill for the new oil; therefore, the saving of a few cents per gallon in the first cost of oil is not a very important consideration.

The value of the right kind of lubricant was recently demonstrated in the plant of a brass company. When an ordinary red engine oil was used for lubricating multiple-spindle automatics, the main spindle bearings would frequently heat up excessively and "freeze," and the machine bearings in general operated at too high temperatures. Also, excessive wear on friction clutch pulleys necessitated renewals at an annual cost of about $250.

For the last eighteen months, a better lubricating oil has been employed on these machines, and during that period not a single spindle has "frozen." There has been no undue heating of any bearings, and no clutch pulleys have been replaced.

In addition to the direct saving of $250 a year for replacements alone, there are also savings in power consumption and additional profits due to increased production, as the machines do not have to be shut down on account of bearing troubles.

In a large plant building road and excavating machinery, the engineer in charge of the maintenance department estimates that a labor saving for maintenance of $1800 a year can be credited to the use of the proper kind of lubricant. Prior to the adoption of a carefully selected oil, lineshaft bearings were removed at the rate of about four a month, or forty-eight per year. Such renewals now average only six per year. A friction test run also indicated that there was a saving in power consumption of 15 per cent.

The buffing department of a plant making high-grade metering equipment found that unsuitable lubricating oil caused excessive wear of the bearings, resulting in polishing wheel chatter. About 4 per cent of the material being polished showed marks due to this chatter, so that repolishing was necessary. By applying a suitable lubricant to the buffing wheel bearings, the wear has been greatly reduced and the number of parts that have to be repolished does not exceed 1 per cent. The time spent in taking up wear alone in the buffing wheel bearings was worth $150 a year, practically all of which has been saved.

Saving Maintenance Costs in a Tractor Plant

In the forge shop of a large tractor plant, the cost of repairing bearings amounted to $540 a year. The lubricant being used was replaced by one recommended for this service. The new oil has been in use for four months and not a single bearing renewal has been necessary.

The blacksmith shop of the same company experienced considerable trouble with a punching machine, the repair costs for which were very high. The bearings on this machine had to be renewed five or six times a year at a cost of about $45 for each renewal. Proper lubrication in this case has eliminated all renewals during the last six months; the bearings have been operating at normal temperatures and no apparent wear has taken place. In all, the maintenance labor cost in this plant has been reduced $2250 by the use of suitable lubricants.

Lubrication of Loose Pulleys

In a plant manufacturing metal-cutting tools, an ordinary grade of engine oil was formerly used for lubricating loose pulleys. The oil consumption was about one ounce per day per bearing, and the bearings had to be renewed every two or three months. A suitable oil, applied correctly, has been substituted. Only one ounce of oil is needed per week per bearing instead of one ounce per day. In six months no bearing has been replaced and the bearings are still in excellent condition. In addition, the oil has to be applied only once every four days instead of twice a day with the former method.

An interesting example of savings effected by proper lubrication is recorded in this article. In a plant manufacturing pneumatic tools, it was estimated that, in 1928, the annual cost of oiling the machines in the plant was $4900. By adopting the correct lubricant and the most suitable method of application, a saving of 25 per cent in the time required for oiling the machines was made. Expressed in dollars and cents, this saving amounted to approximately $1225 per year. In addition, there was a saving in power, estimated at $570 a year. The reduction in repair and maintenance bills indicated that the wear of the bearings had been reduced to a minimum. Against these savings amounting to approximately $1800 a year should be set an increase in lubricant cost of about $20 a year.

An upsetting machine in the forge shop of the same plant, lubricated with an inexpensive cylinder oil, required bearing adjustments every week. A gallon of cylinder oil was used every ten hours. The application of a selected lubricant reduced the oil consumption one-half, and on four upsetting machines decreased the lubricant cost $276 a year. Instead of adjusting the bearings once a week, they are only adjusted once a month. The time for oiling has been reduced to one-third of what was formerly required.

In a shop making outboard motors, burnt-out bearings were common in the grinding department, particularly on one type of machine operating at very high speed. The cost of renewing these bearings was $27 each. The advice of a lubrication expert was asked for, with the result that a suitable oil was recommended. In several instances, the bearings of these machines have now been running over three years without adjustments or replacements. The accuracy of the work produced by these machines has also been maintained within very close limits.

Savings in Power Consumption and Labor Required for Oiling

A plant manufacturing pneumatic tools estimated, in 1928, that the annual cost of oiling the machines was $4900. By adopting a suitable lubricant and the correct method of application, a saving of 25 per cent in the time spent in oiling the machines was made, or approximately $1225 a year. The power saving is estimated at about $570 a year. In this plant no figures are available on the reduction of repairs and maintenance, but the reduced power consumption and the low bearing temperatures indicate that the wear has been reduced to a minimum. Against the savings of approximately $1800 a year should be set an increase in the lubricant cost of about $20 a year.

Applying Oil Properly

In an effort to provide adequate lubrication, it is not only the character of the lubricating oil, but also the means provided for bringing the oil to the bearing that are of importance. Wick-feed oilers and bottle oilers are valuable substitutes for ordinary hand oiling. Bottle oilers need be filled only once in four to six weeks, and wick-feed oilers only once every two days, whereas the ordinary simple hand-feed devices that have been replaced in the cases mentioned required two or three fillings a day. Proper oiling devices reduce the oil consumption to a great extent, so much so that even though a higher grade of oil is used, the total lubricant cost is often less than when the inferior oil is used.

In a large middle-western plant, the number of man-hours required per day for lubricating the equipment has been reduced from forty-five to thirty-seven, with an estimated saving of over $1000 a year. Hand oiling may be said to be always a wrong method if it is possible to use a lubricating device that will control the oil supply and assure a uniform application of the oil.

Along with the recommendations for lubricating devices and the use of the right kind of oil for each application, it is often advised that bearings be regrooved, because the oil-grooves in bearings on many machines are erroneously applied; hence, in many cases, when savings have been effected, correct grooving of the bearings should be partly credited with the improved performance. By taking all of these factors into consideration, the oil consumption per day has, in some instances, been reduced in the proportion of 4 to 1; that is, where

four quarts were formerly used, one quart is now sufficient.

Unusual Results Obtained in an Automobile Plant

As a last example of the advantages to be gained by proper lubrication of machine shop equipment, the results obtained in a well-known automobile plant will be quoted. A careful test was made in this instance of the piston machining line. Records of production, power consumption, and lubricant costs were kept for a period of six weeks, during which time an ordinary lubricant was employed. At the conclusion of this period, a lubricant specially selected for the service to be rendered, and applied by proper lubricating means, was tested.

Owing to the fact that there were fewer breakdowns, no shut-downs of machines because of bearing troubles, no interferences with production for the purpose of oiling machines, and fewer rejections of work because of the elimination of chatter, the daily production was increased over 40 per cent. In spite of this increase in production, the actual power consumption was reduced about 24 per cent.

A frictional load test was also made—all belt-driven machines in the line running, but without performing any cutting operations. This test showed a reduction of over 25 per cent in the frictional load when improved lubricants and lubricating means were used. In some instances, a high-grade oil was employed instead of grease, and the regular application of the right amount of oil to each machine was carefully studied.

In this instance, the cost of the lubricant recommended was considerably higher than the cost of the oil formerly used, but the reduction in oil consumption was so great that the total cost for lubricants was reduced 35.8 per cent.

The examples given show definitely that it is worth while to pay attention to what kind of lubricant is used in the machine shop and what kind of devices are employed to bring the lubricant to the bearing surfaces.

Progress in Gear Standardization

The American Gear Manufacturers' Association, at its Annual Meeting in Buffalo, Adopted Several New Standards for the Gear Industry

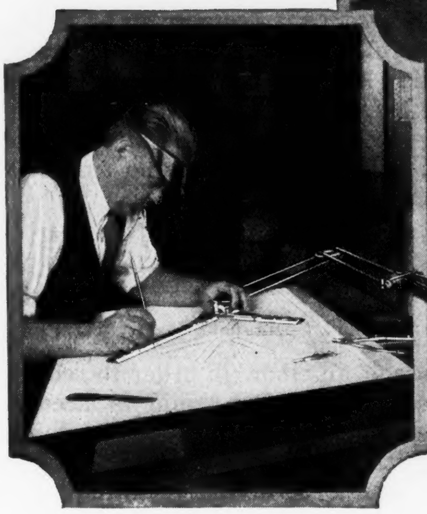
At the fifteenth annual meeting of the American Gear Manufacturers' Association, held in Buffalo, N. Y., May 7 to 9, the Association adopted, as recommended practice for the gear industry, a number of important reports presented before the meeting.

The very complete report of the Nomenclature Committee, giving definitions, symbols, abbreviations, and formulas to be used in gear design and calculations, was adopted as recommended practice. Another outstanding report presented by the Inspection Committee, illustrating and describing a great number of inspection devices for use in gear manufacture, was similarly adopted. The Bevel and Spiral Gear Committee presented formulas, tables, and methods for computing the allowable tooth loads and stresses in bevel and spiral-bevel gears, and the Keyway Committee presented its final report on standard keyways for holes in gears. Both of these reports will become part of the recommended practice of the Association. The Commercial Standardization Committee presented an important report relating to the subject of cost accounting, and a standard proposal form was presented and adopted.

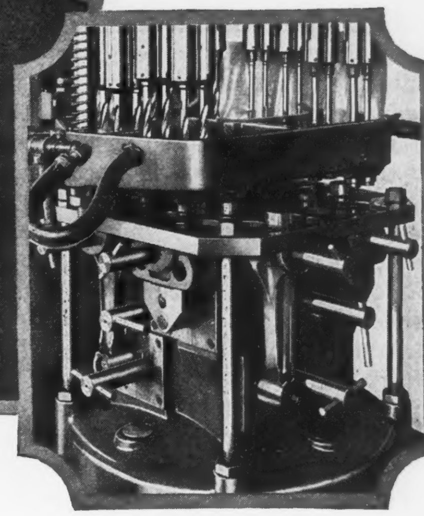
The Worm-gear Committee presented a report of considerable interest, recording test data on worms and worm-gears, which indicated that existing formulas in handbooks give rather too low values for the horsepower that may be transmitted by accurately cut worm-gears properly mounted and running in oil. The reason that such low values were formerly used for the horsepower ratings of worm-gearing is doubtless that worm-gears did not always run under the ideal conditions possible to provide if the best workmanship, together with proper installation and running conditions, is assured.

At the meeting, three important papers relating to advances in the methods of the gear industry were presented. C. W. Mansur of the Plastics Department of the General Electric Co. read a paper on "Non-metallic Gears and Their Operation Characteristics," dealing comprehensively with this subject. This paper will be published in MACHINERY. A paper by R. V. Baud of the Westinghouse Electric & Mfg. Co., entitled "Photo-elastic Study of Contact Stresses in Gears," dealt with a new method of determining stresses, the general principles of which are illustrated and described in the leading article in this number of MACHINERY. The paper dealt specifically with the application of the method to gear teeth, showing, in detail, how the amount of stress may be computed from the stress diagrams.

In a paper entitled "Strength and Durability of Spur-gear Teeth," Professor Earle Buckingham of the Massachusetts Institute of Technology summarized the results of six years' experiments on the strength of gear teeth, giving working formulas and tables to be used in designing gears for strength and wear. These formulas will doubtless become the standards for gear calculations, amplifying and modifying the well-known Lewis formula in the light of the exhaustive experiments recently conducted.



Design of Tools and Fixtures

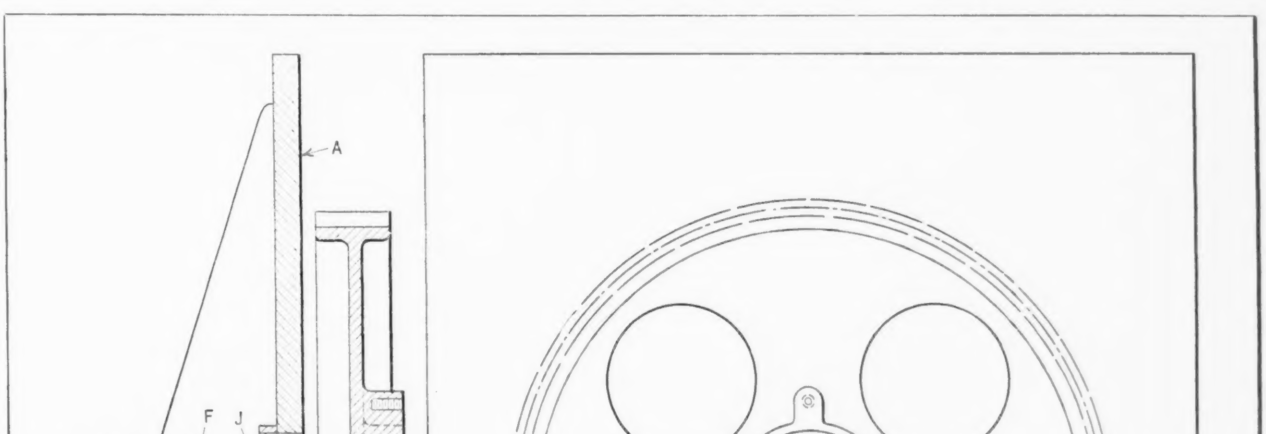


Fixture for Milling Helical Groove in Gear Hub

By FERGUS O'CONNOR, Machine Shop Foreman
Riley Stoker Corporation, Detroit, Mich.

In the main drive gear used in connection with a mechanical stoker, a helical groove is machined in the face of the hub. This groove is engaged by a pin which throws in a clutch at a predetermined time. The helical groove was machined in a boring mill, using a threading attachment to obtain the desired feed, but this method proved unsatisfactory, as it was necessary after each cut to return the table to a certain point in relation to the position of the head.

The operation is now performed in a standard boring mill of the horizontal type, using the fixture shown in the illustration. An end-mill of a diameter equal to the width of the helix completes the helical groove in one cut. The fixture consists chiefly of a cast-iron angle-plate *A* and the shaft *B*,



Hand-operated Fixture for Milling Helical Groove in Face of Gear Hub

which is turned down on one end to receive the work. Near the center of this shaft is cut a thread having a lead equal to that of the helix to be milled. This threaded portion engages the nut *J*, which is babbitted in position with the shaft in place in order to insure an accurate job.

The fixture is located on the table of the machine at the same angle as the helix lead, so that the bottom of the groove will be flat. The shaft *B* is free to turn in the hub *F*, which is secured to the angle-plate, both shaft and gear being rotated by the pinion *E*, which, in turn, is operated by the hand-wheel *G*.

In operation, the gear is placed on the end of the shaft *B* and secured by means of the strap *H*. The end-mill is fed to the required depth into a hole previously drilled in the hub of the gear. The gear is rotated by the handwheel and at the same time is given an axial movement by means of the nut *J*, corresponding to the lead of the helix. The helix continues around the hub for only one-quarter of a revolution of the gear, so that the strap does not interfere with the cutter.

The width of the groove is required to be milled within limits of minus 0.000 and plus 0.003 inch, and the depth within limits of plus 0.000 and minus 0.005 inch. The time required to machine the groove by the former method was 110 minutes for each gear. With the fixture shown, the time has been reduced to 28 minutes.

Machining a Curved Bore

By F. H. MAYOH, Springfield, Mass.

Boring the inside of an elbow in order to reduce the friction caused by flowing liquid is accomplished in a rather ingenious manner by means of the equipment illustrated in Figs. 1 and 2. The elbow, which is shown at *A* in Fig. 1, is mounted on a power-driven circular table *B*, which, in turn, is secured to the table of a standard horizontal bor-

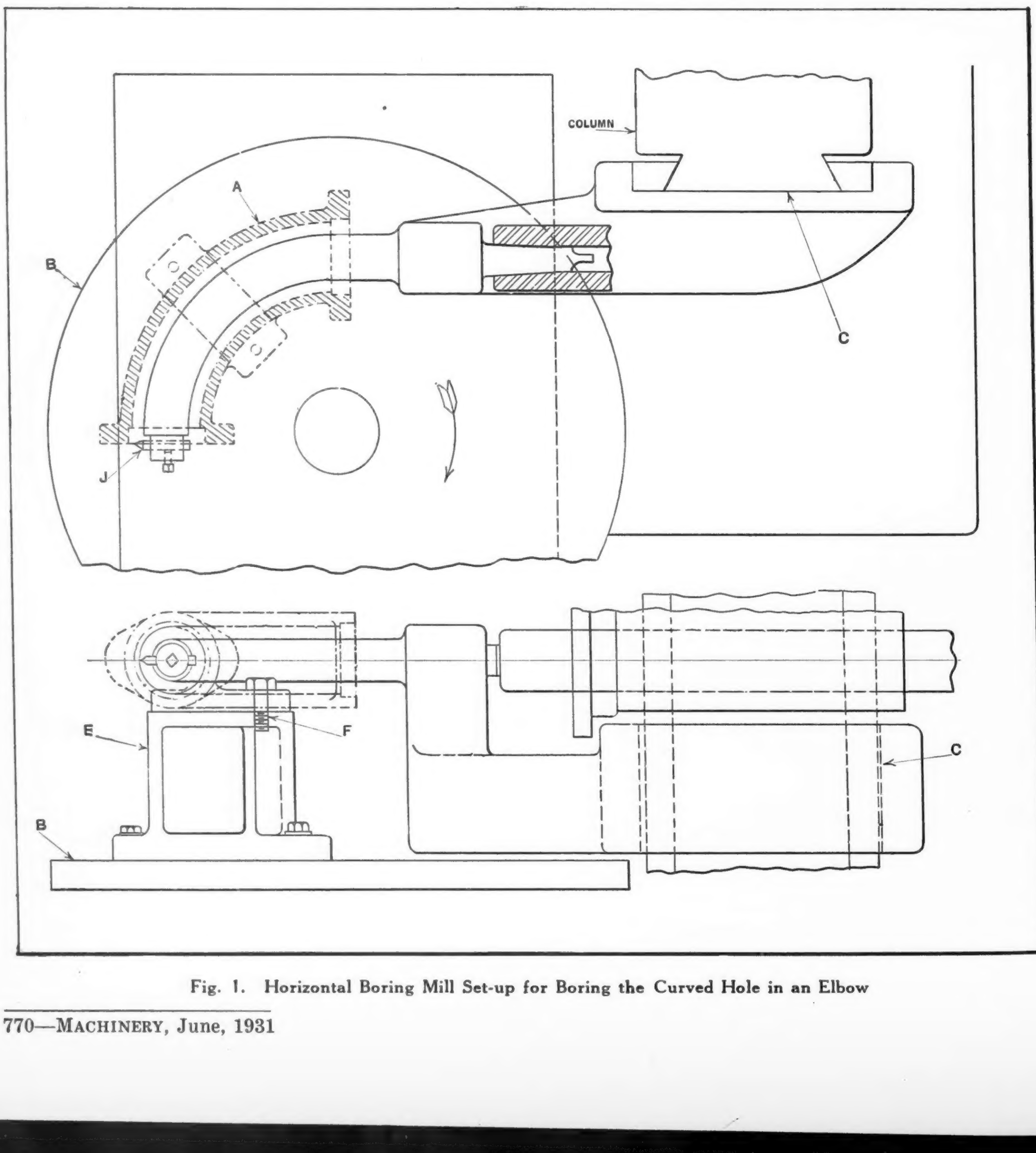


Fig. 1. Horizontal Boring Mill Set-up for Boring the Curved Hole in an Elbow

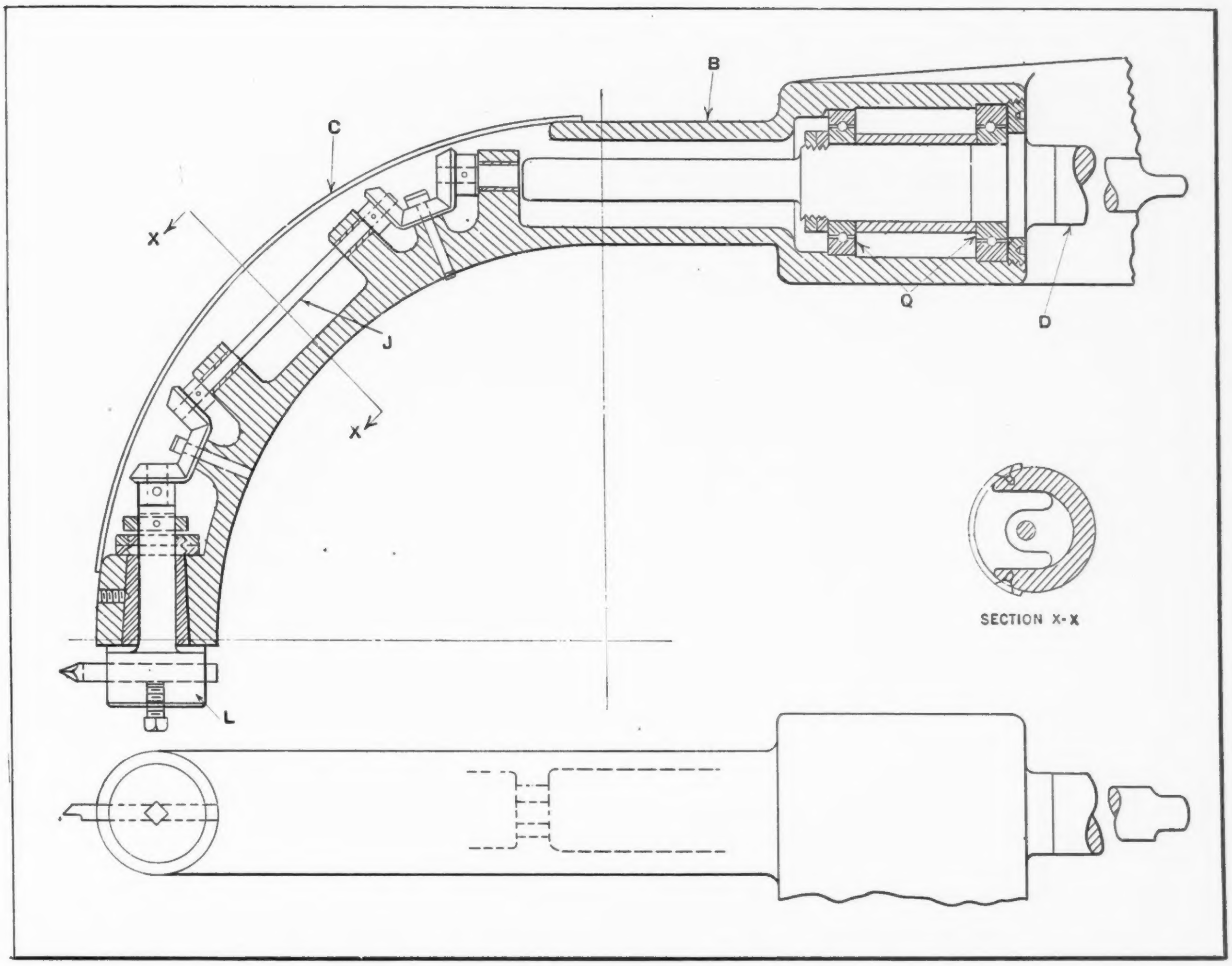


Fig. 2. Sectional View of Boring-bar Used in Set-up Shown in Fig. 1

ing mill. This job could be done on a milling machine by a slight adaptation of the equipment.

The body of the boring-bar is made of cast iron and is of a gooseneck shape. It is clamped at *C* to the vertical guides of the boring mill just below the spindle head. Block *E*, which is bolted to the circular table, supports the elbow, the latter being secured by means of the screws *F*.

The table is shown with the cutter *J* located at the end of the bore, the table having been rotated through 90 degrees in the direction indicated by the arrow. During this movement, the cutter bores the entire length of the hole as the gooseneck passes through the elbow. Cutter *J* is rotated by a train of bevel gears driven from the machine spindle.

The internal construction of the boring-bar is shown in Fig. 2. Here, the cast-iron body is indicated at *B* with an opening at one side to facilitate the boring of the gear-shaft bearings and the assembly of the gear train. The opening, a section of which is shown at *X–X*, is enclosed by a cover *C* to exclude dirt and chips, and it is fastened to the body by means of screws. The tapered shank *D*, on one end of which is secured the first gear of the train, fits into the tapered hole in the driving spindle of the machine and is mounted in the ball bearing *Q*. In order to eliminate play in the cutter-head *L*, a split bushing is provided for its shaft and it may be adjusted by end nuts. This also eliminates much of the chatter that would otherwise be produced by the overhang of the boring-bar.

Die with Unusual Ejecting Arrangement

By C. W. HINMAN, Tool Designer
Kobzy Tool Co., Chicago, Ill.

The compound blanking and drawing die illustrated in Fig. 1 is employed for making the part shown in Fig. 2. In this die, the strip stock is guided in a stripper plate *F* which has a vertical sliding movement. This plate is mounted on four screws *G* fastened in the die-shoe, and is backed up by springs. The strip is held down on the die during the operation by means of four spring pins *I*, mounted in the punch-block.

An added function of the stripper plate is to lift the stock clear of the die-block to allow the finished part to slide out from under the strip. The press is of the inclined type to facilitate this action.

This type of stripper plate is necessary because of the high speed at which the press is operated, which makes it essential that the strip stock be

closely confined while being fed by rolls through the die. The rapid feed of the strip would be impossible if the part were carried out of the die with the strip, as the stripper channel would have to be made larger, which would allow the strip to buckle. The blanking punch *B* is mounted on the face of the punch-holder, and the round die-block *C* is secured in the die-shoe.

As the punch descends, the four pins *I* in the punch-holder come in contact with the stripper plate *F* and carry it down with the strip of stock. The four springs in the die-shoe, which support the stripper plate, have less resistance than the springs behind the pins *I*. Therefore, the pins have no movement relative to the punch-block until the strip reaches the die. Then the springs behind pins *I* are compressed, providing the required pressure to hold the stripper plate and stock firmly in position while the blank is being cut.

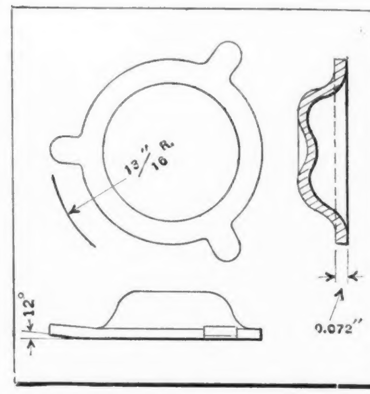


Fig. 2. Part Made in the Die Shown in Fig. 1

Further descent of the punch causes the blank to be forced down against the blank-holder *D*, which is actuated by the spring *K*. Continued downward movement of the punch causes the blank to be drawn over the forming punch *E* secured in the die-shoe, thus forming the dished part of the work. However, just before the dishing action takes place, the forming punch *A*, sliding in member *B*, bottoms against the hardened plate *J* in the punch-holder and indents the bottom of the work.

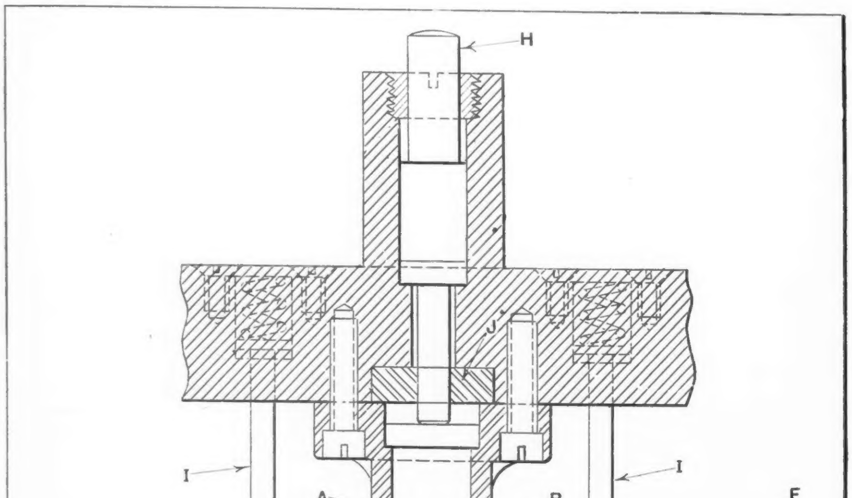


Fig. 1. Die in which the Strip is Elevated after Each Stroke to Allow the Part to be Ejected

The 12-degree angles indicated on the ears of the work in Fig. 2 are formed by the face of member *B*, Fig. 1, which is ground to correspond with this angle. When the punch-holder begins to ascend, the blank-holder *D* pushes the completed work upward through the die and, at the same time, holds it firmly against the face of punch *B*. As the work leaves the blank-holder, it may cling to the inside of punch *B*, in which case it will be ejected when the punch-holder has ascended far enough to allow the knock-out bar to force pin *H* down. The strip, at this time being in an elevated position, allows the part to slide sidewise under the strip until it drops into a container at the rear of the press.

This job is performed on a high-speed automatic-feed punch press, and the average production in a nine-hour day is over 2900 pieces per hour.

Blanking and Forming Die for Cable Clips

By WILLIAM C. BETZ, Master Mechanic Fafnir Bearing Co., New Britain, Conn.

Doubtless the die described on page 281 of December MACHINERY was designed for producing a small quantity of the part shown in Fig. 1, as otherwise, it would have been more economical to design a die that would complete

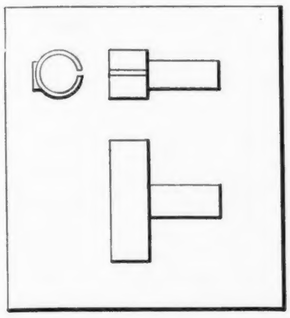


Fig. 1. Electric Cable Clip

each piece at one stroke of the press. Also, the method of feeding the parts into the die by hand is both slow and dangerous. An improved design, in which all the operations are combined, is shown in Fig. 2.

This die could be used on a single-action press, and the strip fed by hand at a rate that would allow a production of about 25,000 parts in ten hours, or if a high-speed press were available, as many as 80,000 pieces in ten hours could be produced, using coil stock and a roll feed.

In starting the strip into the die, it is fed to a finger-stop *A*. With the strip in this position, the two rectangular notches *B* are cut on each side of the strip. These notches form the straight portion of the clip. The finger-stop also locates the strip on the second stroke of the press, so that the punch *C* will enter one of the notches previously cut, thus positioning the strip while the next two notches are being cut.

On the third stroke, and for every stroke thereafter, the automatic stop *D* locates the strip for all operations. As the ram descends, the head of the forming pin *E* comes in contact with the angle-piece *F*, which pushes the forming pin toward the right. At the same time, faces *G* and *H* come together, the angle-piece taking the thrust of both the forming pin holder *N* and the shearing punch *J*. This punch severs the clip from the strip just before the upper forming punch *K* closes the loop in the clip. As the head of the forming pin *E* leaves the angle-piece *F*, the spring *L* forces pin *E* out of the loop in the clip. The clip is then ejected from the die by a jet of compressed air.

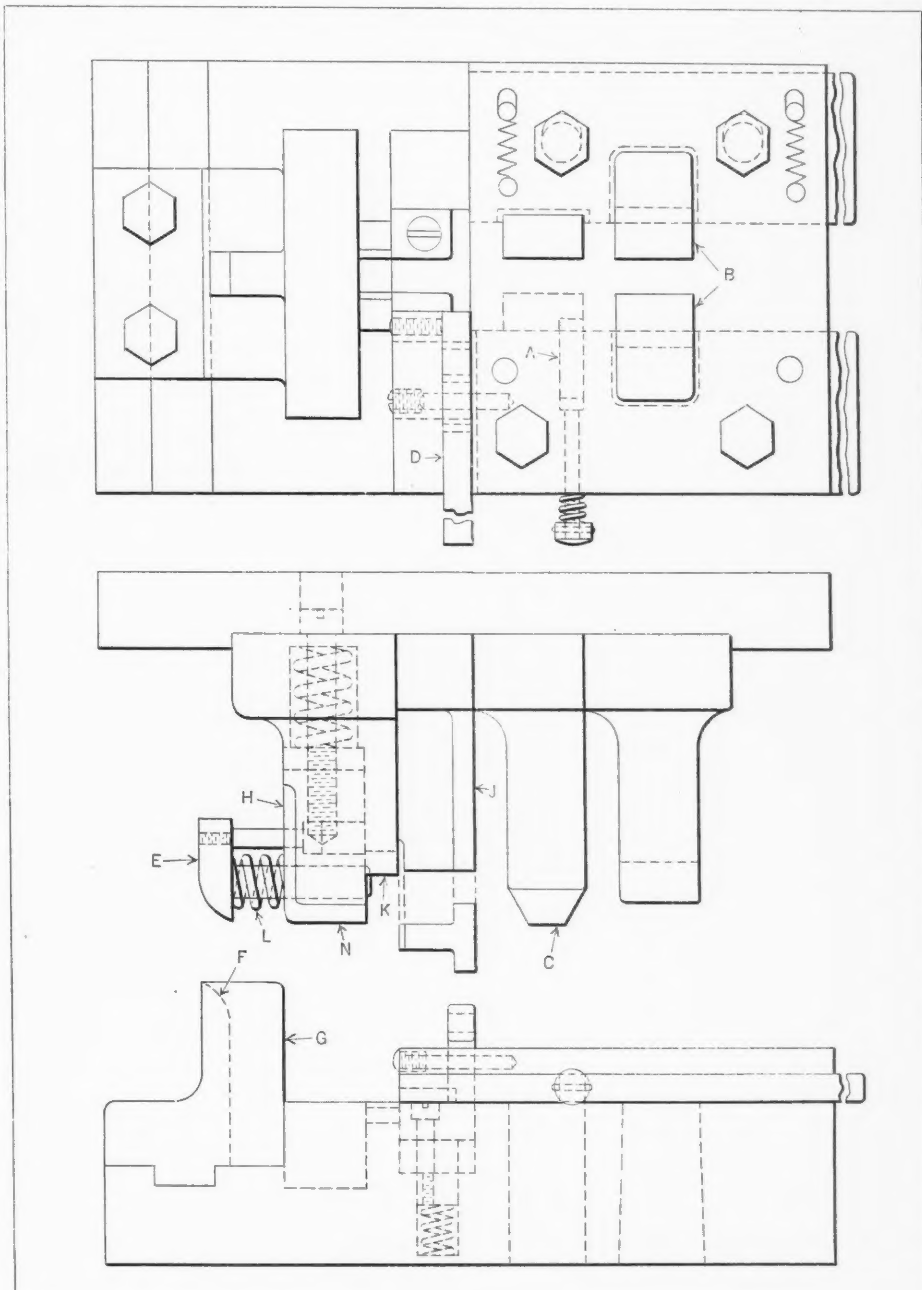


Fig. 2. In this Die the Clip Shown in Fig. 1 is Blanked and Formed to a Cylindrical Shape at One Stroke of the Press

Chuck for Crankcase Covers

By CHARLES C. TOMNEY, Tool Designer and Time Study Engineer, Brunswick-Kroeschell Co.

At the left, Fig. 1, is shown the outer or stuffing-box side of the rear crankcase cover of an ammonia compressor engine, and at the right the inner ribbed side. A cross-section is shown in Fig. 2.

The first operation on this cover consists of chucking the work in a three-jaw chuck and machining the surfaces indicated at *A*, Fig. 2. The second operation consists of facing the surface *B* and boring the stuffing-box *C* concentric with the 5-inch reamed hole and the rim, which was previously machined to a diameter of 16 3/4 inches.

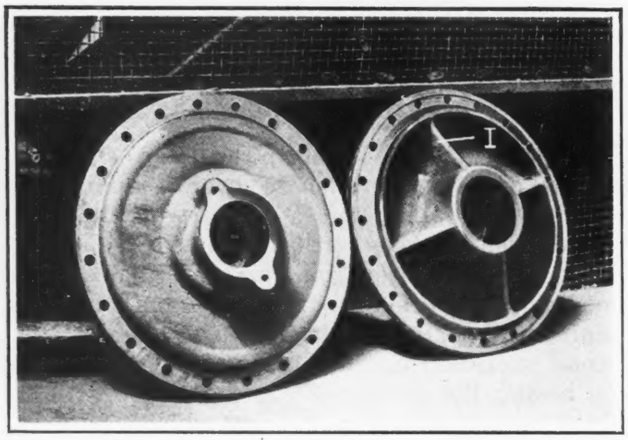


Fig. 1. Crankcase Cover for which Chuck Shown in Fig. 3 was Designed

As it is desirable that the surface *B* and the bore *C* in the stuffing-box be accurately aligned and at right angles, within close limits, the holding fixture shown in Fig. 3 was designed, which permits machining these surfaces at one setting.

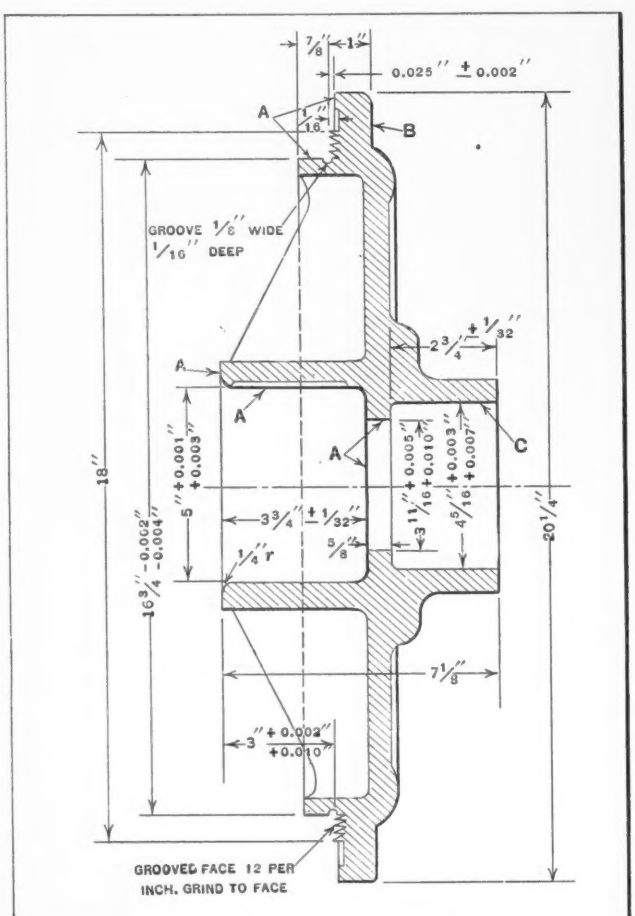


Fig. 2. Cross-section of Cover Shown in Fig. 1

The hub *D*, Fig. 3, is bored to receive a hardened and ground bushing, which serves as a bearing for the pilot of the boring-bar. Hub *D* is also machined to a close fit in the 5-inch bore in the hub on the ribbed side of the cover. The fixture is counterbored at *E* to give a close fit over the 16 3/4-inch rim of the cover. The grooved face of the cover rests against the finished surface of the fixture. All the machined surfaces must be concentric, and any of them might be used for locating purposes. The hub was selected for this purpose, however, as it extends beyond the grooved face and thus facilitates loading and unloading the work.

The clamps *H*, Fig. 3, are slotted to fit loosely over the webs *I*, Fig. 1. The set-screws *O* on clamps

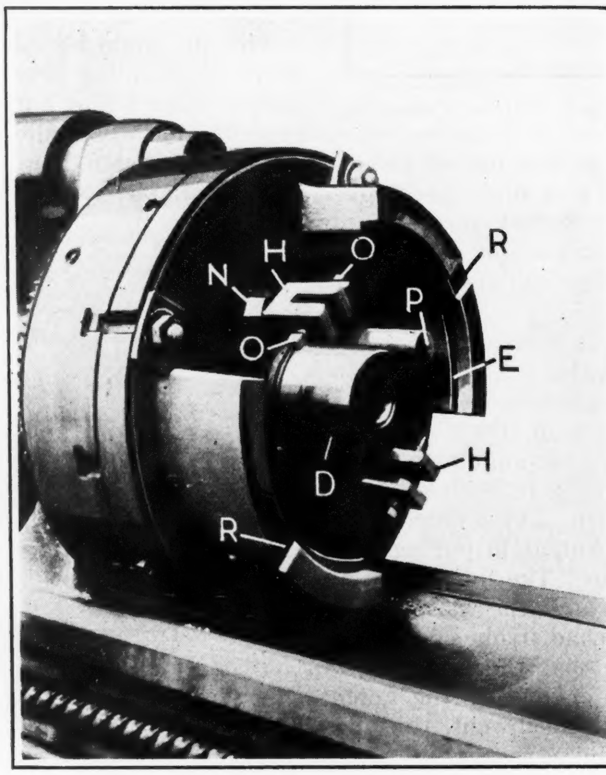


Fig. 3. Special Chuck Used in Facing Surface B and Boring the Hub at C, Fig. 2

H, Figs. 3 and 4, are tightened on the webs, after which the cover is clamped to the fixture by turning the threaded sleeve *J* by means of a wrench applied to the nut *N*, Fig. 4.

The sleeve *J*, Fig. 4, is a loose fit in the base *K* of the fixture. The flange *L* at the end of this sleeve serves to take the thrust when the clamping action is applied. The two set-screws *O* have sufficient gripping power to hold the work securely against the chuck, while a steel stud *P*, Fig. 3, which bears against one of the webs *I*, Fig. 1, serves as a driver. The slots *R*, Fig. 3, provide a clearance for prying off the fixture cover at the end of the operation.

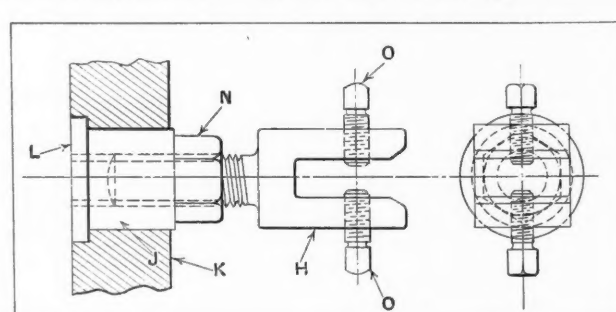
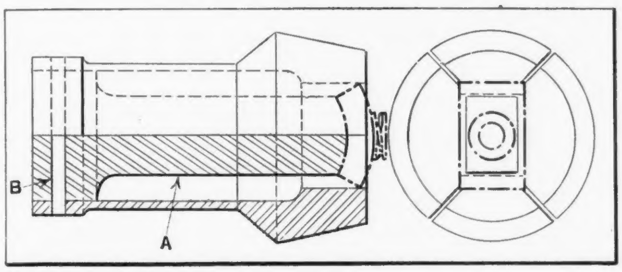


Fig. 4. Details of Clamps H, Fig. 3

Ideas for the Shop and Drafting-room

Time- and Labor-saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



Lathe Collet in which a Work-stop is Incorporated

Draw-in Collet with Positive Stop

Usually when a spring collet is used in a turret lathe, the piece to be machined is located longitudinally by means of a stop secured in one of the turret stations. With the collet shown in the illustration, however, an extra turret station is free to be used for cutting tools, as the stop is combined with the collet itself. The work for which this collet is used is shown in heavy dot-and-dash lines. One end is drilled and turned, while the other end is milled to a rectangular shape.

For the drilling and turning operation, the rectangular end is gripped in the spring collet shown, which has an opening of the same shape as the work. When placed in the collet, the work is seated against the stop *A*, one end of which is shaped to conform to the work. This stop is a press fit in the rear end of the collet, and is further secured by means of the pin *B*, so that every piece is located in the same position. While this stop was designed for the particular job shown, the same principle can be employed for various classes of work in which a collet of either the draw-in or push-out type is used.

Cleveland, Ohio — W. N. Delenk

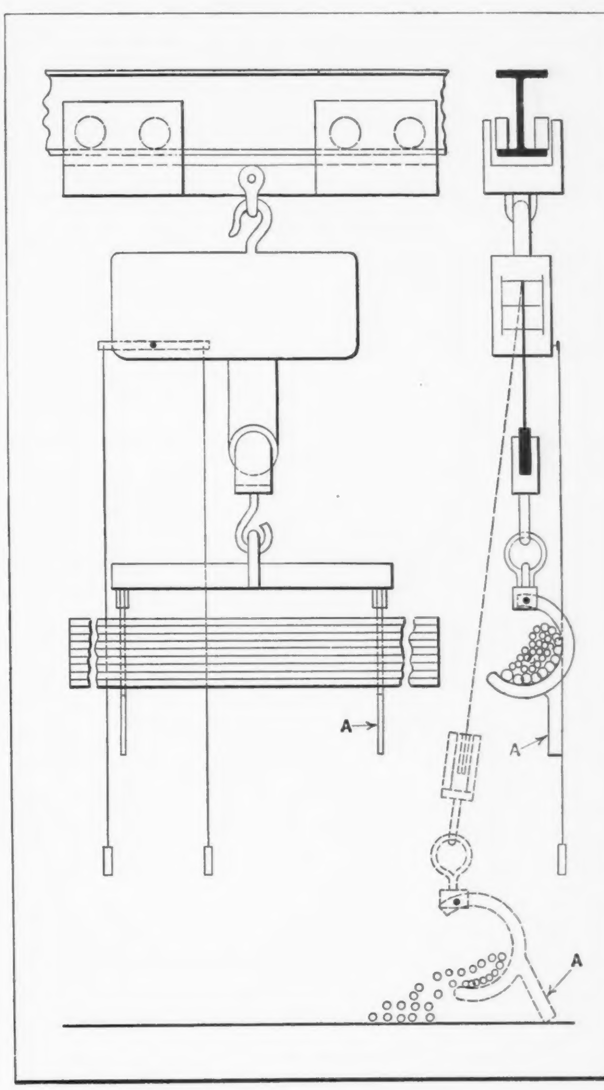
Automatic Dumping Carrier for Hoist

In the accompanying illustration is shown, diagrammatically, a quick-dumping monorail carrier which operates automatically. This carrier was designed at a large manufacturing plant in St. Louis, Mo., for use in transporting and piling bar iron, rods, pipe, and other light material received in long lengths.

The monorail extends from the loading to the unloading station, and from the trolley is suspended an electric hoist to which the carrier is attached. The carrier consists of a long heavy bar with an open hook hinged at each end. These hooks are hinged in such a way that they are free to swing at right angles to the length of the bar. On the lower side of each hook, and offset some distance from the vertical center line, is an extension piece *A* which is welded in place.

In using the carrier, the material to be moved is loaded into the two hooks. At this time the carrier may either be suspended from the hoist or supported in a vertical position by means of a stand made for that purpose. To unload, the hooks are lowered by means of the hoist until the extensions *A* come into contact with the floor or the material already in the pile; and since the center of gravity of the load is in front of these extensions and toward the open side of the hooks, further descent causes the hooks to swing forward and dump the load out on the floor. The dotted outline indicates the position of the carrier when unloading.

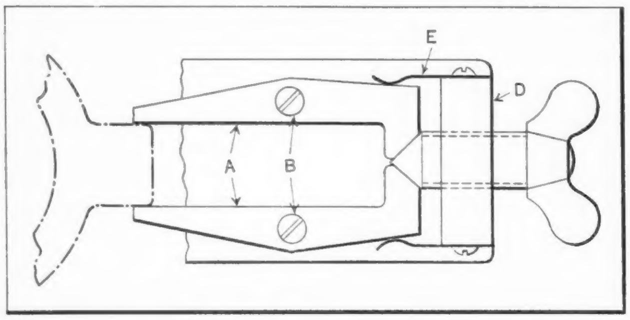
St. Louis, Mo. — Paul Homer White



Carrier for Electric Hoist which Automatically Dumps the Load when it Reaches the Floor

Positive Locator for Jig or Fixture

The usual method of locating work lugs in jigs or fixtures is by means of pins, the distance between the pins being somewhat greater than the width of the lugs. In many cases, this added clearance causes errors in the location of the drilled holes or milled surfaces. With the type of locator shown in the illustration, however, this clearance is entirely eliminated, as the locator rests directly against the lugs on both sides.



Adjustable Locator for Work Lugs in Jigs and Fixtures

This locator is of simple design and consists merely of two fingers *A* which oscillate about the studs *B*. At one end of these fingers a conical pointed screw is threaded in a block *D* secured to the fixture. By turning this screw, the fingers are closed in against the lug, thereby locating the work accurately. Springs *E* are provided to force the fingers open when the screw is loosened.

Boston, Mass. CHARLES R. WHITEHOUSE

Using Tracing Cloth for Bills of Material

In the plant in which the writer is employed, the bills of material were formerly printed or typed on thin semi-transparent paper, and from these sheets blueprints were made and sent into the shop. The original or master bill was retained in the engineering department. As it was frequently handled, the pages became creased, torn, and soiled after a while. When erasures had to be made, this thin paper often was torn and the prints made from these originals were sometimes illegible, causing serious errors in the shop. To remedy this condition, a new method was adopted, which has now been in successful use for four years.

We take tracing cloth and cut it to the same size as the sheets of the bill of material. These cloth sheets are ruled on the reverse side with ink corresponding to the lines on the thin paper sheets. The rules are put on the reverse side so that the entries that are made on the opposite side can be erased without removing the lines. Erasures can easily be made on the tracing cloth without damage.

The blueprints made from these tracings today are as legible as the first blueprints that were made from the tracings four years ago. Had we continued to use the thin paper bills of material for making blueprints, we would have had to rewrite them entirely at least four times in four years.

Sponging with naphtha at intervals removes any oil and dirt that may accumulate on the sheets, and if they are kept in a stiff-backed binder, they will seldom have to be replaced.

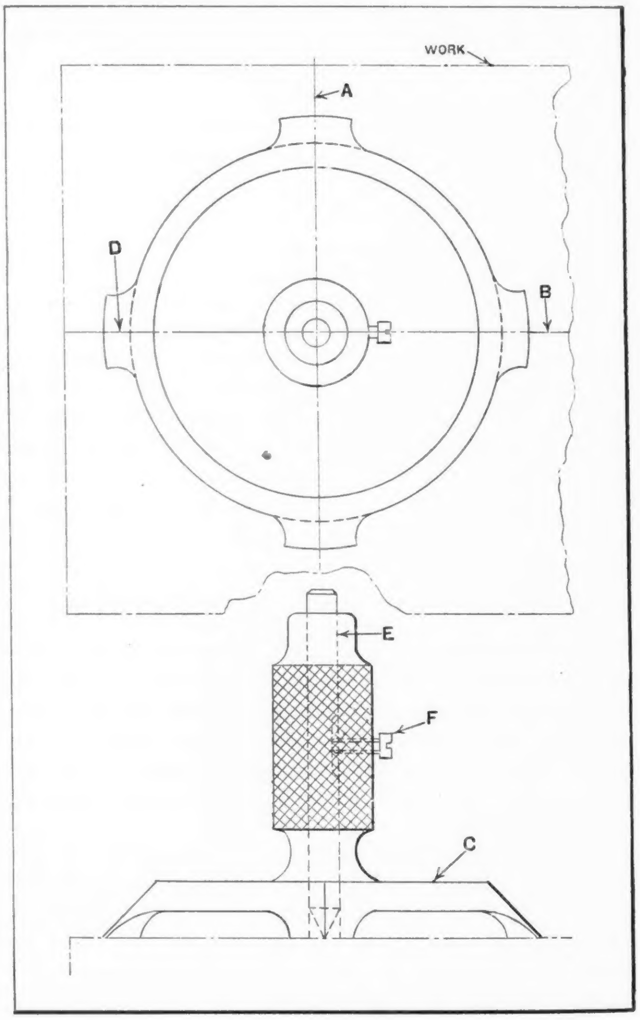
Harvey, Ill. JULES J. SIEKMAN

Accurate Center-punch

Center-punching intersections of lines accurately requires some degree of skill. With the tool shown in the illustration, the center-punch is located exactly at the intersection of the lines by lining up corresponding lines on the body *C* of the tool. As shown, the two intersecting lines *A* and *B* are first scribed accurately on the work. The tool is then placed on the work and shifted around until the four lines *D* on the tool line up with those scribed on the work. A light hammer blow on the punch *E* then produces the required mark at the exact intersection of the lines.

The four lines *D* on the tool should be scribed by means of an indexing head to make sure that they are 90 degrees apart. The center-punch is a slip fit in the tool, and is prevented from dropping out by the screw *F*.

Philadelphia, Pa. C. KUGLER



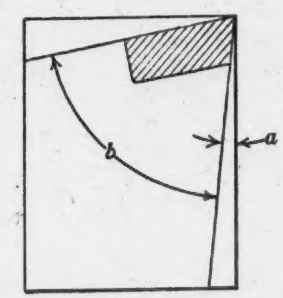
Tool for Accurately Locating Center-punch Mark at Intersection of Two Lines

MACHINERY'S DATA SHEETS 203 and 204

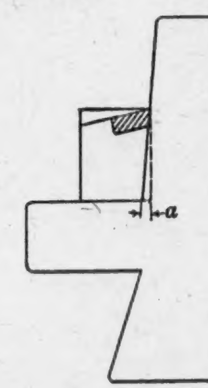
GRINDING ANGLES FOR WIDIA TUNGSTEN-CARBIDE TOOLS

IMPORTANT RULES FOR THE GRINDING OF WIDIA TOOLS

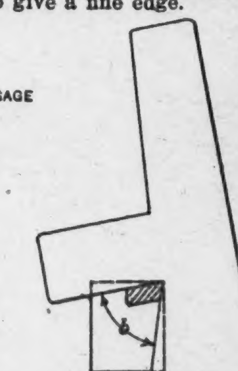
1. Make sure that the tool ground has a fine, smooth-cutting edge.
2. Use plenty of water in grinding tool.
3. If necessary to grind dry, do not dip hot tip of tool in water to cool, and do not allow tip to become overheated in either wet or dry grinding.
4. Use a wheel especially adapted for grinding tungsten-carbide tools, which runs true and vibrationless.
5. Maintain angles given in table.
6. Use only a light pressure in applying the tool to the wheel and grind from the front and side of the tool, not from the top unless necessary.
7. Keep the clearance angle beneath the cutting edge as small as possible, and finish-grind on the front of a cup-wheel if possible, maintaining a flat rather than a concave surface.
8. Avoid chipping by having the grinding wheel rotate toward the cutting edge, and not away from it.
9. It is best to have a carefully instructed man grind all tungsten-carbide tools instead of allowing each man to grind his own tools.
10. In general, it is preferable to grind Widia tools by hand instead of in a holder. When a fixture must be used, do not use a feed per pass of more than 0.0005 inch. Finishing should be done by hand on a carefully trued wheel to give a fine edge.



END VIEW OF SIDE-CUTTING TOOL



GAGING CLEARANCE



GAGING TOOL ANGLE

Gages or templets similar to the ones shown in the illustration should be made up with angles corresponding to the values given in the table for use in grinding Widia tools for machining different materials.

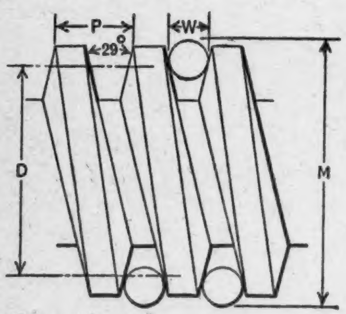
Material to be Machined	Clearance Angle a, Degrees	Tool Angle b, Degrees	Material to be Machined	Clearance Angle a, Degrees	Tool Angle b, Degrees
Soft Steel	4	60 to 65	Soft Steel Castings...	4	68 to 73
Hard Steel	4	65 to 74	Hard Steel Castings..	4	73 to 78
Manganese Steel	4	80 to 84	Gray Iron Castings...	4	74 to 80
Stainless Steel	4	65 to 74	Bronze, Brass, etc....	6	65 to 75
Chilled Cast Iron....	3	82 to 86	Aluminum Alloys	8	50 to 55

This table applies specifically to turning tools. Planer tools should be ground as specified in the table except that they should be given a negative back rake of 12 to 15 degrees.

MACHINERY'S Data Sheet No. 203, New Series, June, 1931

Contributed by Thomas Prosser & Son

MEASURING ACME AND WORM THREADS—THREE-WIRE METHOD



M = measurement over wires;
D = pitch diameter of worm;
P = pitch of thread;
A = constant = $P \div 0.51724$;
W = wire diameter; and
B = constant = $4.994W$.

The table gives the constants A and B, with corresponding thread pitches, threads per inch, and wire diameters. If the wire given is not available, use the nearest size and multiply the diameter by 4.994 to obtain the correct constant B.

$$M = D - A + B \qquad (1)$$
$$D = M + A - B \qquad (2)$$

Example—Find the measurement over the wires for a worm having a pitch diameter of 3 inches and a pitch of 1 inch.

$M = 3 - 1.9333 + 2.8091 = 3.8758$ inches

Example—If the measurement over the wires for a worm thread having a pitch of 0.6 inch is 3.578 inches, what is the pitch diameter of the worm?

$D = 3.578 + 1.16 - 1.658 = 3.08$ inches

Pitch	Threads per Inch	A	B	W
2.0000	1/2	3.8667	5.6182	1.1250
1.7500	4/7	3.3334	4.9938	1.0000
1.5000	2/3	2.9000	4.3697	0.8750
1.3750	8/11	2.6584	3.7455	0.7500
1.2500	4/5	2.4167	3.4333	0.6875
1.0000	1	1.9333	2.8091	0.5625
0.8750	1 1/7	1.6917	2.4970	0.5000
0.7500	1 1/3	1.4500	2.0625	0.4130
0.6250	1 3/5	1.2083	1.8727	0.3750
0.6000	1 2/3	1.1600	1.6580	0.3320
0.5000	2	0.9667	1.3833	0.2770
0.4375	2 2/7	0.8458	1.2485	0.2500
0.4000	2 1/2	0.7733	1.1386	0.2280
0.3750	2 2/3	0.7250	1.0437	0.2090
0.3333	3	0.6444	0.9239	0.1850
0.3000	3 1/3	0.5800	0.8290	0.1660
0.2500	4	0.4833	0.7016	0.1405
0.2000	5	0.3867	0.5493	0.1100
0.1666	6	0.3221	0.4669	0.0935
0.1428	7	0.2761	0.3920	0.0785
0.1250	8	0.2417	0.3496	0.0700
0.1111	9	0.2148	0.3171	0.0635
0.1000	10	0.1933	0.2747	0.0550
0.0909	11	0.1757	0.2597	0.0520
0.8330	12	0.1610	0.2322	0.0465
0.0769	13	0.1487	0.2097	0.0420
0.0714	14	0.1381	0.1997	0.0400
0.0625	16	0.1208	0.1748	0.0350
0.0555	18	0.1074	0.1548	0.0310
0.0500	20	0.0967	0.1398	0.0280
0.0454	22	0.0878	0.1248	0.0250
0.0416	24	0.0805	0.1123	0.0225

MACHINERY'S Data Sheet No. 204, New Series, June, 1931

Contributed by John P. Gast

How Many Apprentices Remain Permanently in the Shop Where They Have Been Trained?

By C. J. FREUND, Apprentice Supervisor, The Falk Corporation, Milwaukee, Wis.

THE employer who is making a thorough investigation of the possibilities of apprentice training is likely to ask the question "Will apprentices remain permanently with the firm that has spent money, time, and effort on training them?"

He may say: "I have been told that in one plant 78 per cent of the graduated apprentices remain with the employer after graduation. That doesn't mean a thing to me. I am interested in the long-term results of this training work. I want to know what can be accomplished over a number of years. Of the 78 per cent who remain after graduation, some may stay three weeks or even three days, and then leave never to return. They might as well have left immediately. On the other hand, others may leave after graduation, but return later on and remain permanently. The really important thing to me is: What proportion of the apprentices who have graduated over a period of years will be found working in the shop right now?"

In a former article (May MACHINERY, page 678) the author mentioned that 169 apprentices graduated in the plant of the Falk Corporation from January 1, 1924, to May 30, 1929. No apprentices graduated between May 30, 1929, and June 10, 1930. On June 10, 1930, the names on the payroll were examined, and it was found that 91 of the 169 apprentices who have graduated during the last six and one-half years were on the payroll. This is 53 per cent of the total. Similar investigations at other times have shown that from 48 to 54 per cent of all graduates will be found employed in the shop at any one time.

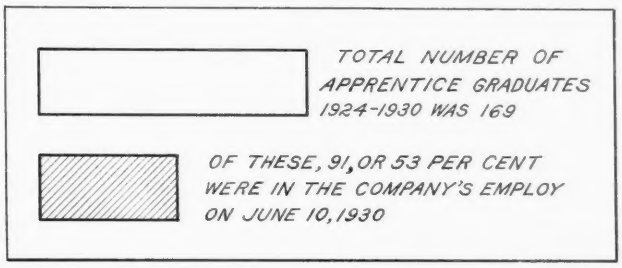


Diagram Indicating the Experience of the Falk Corporation with Apprentices who Have Completed their Training

Of course, these percentages will vary in the case of corporations who have been training apprentices for a long period of years, because as the years go on, it is evident that some men will be tempted by good offers elsewhere; and in addition, some will have passed away through death.

There are other incidental advantages of apprenticeship training to which attention may be called. Apprentice graduates who go with other firms often remain staunch friends of the firm that trained them, believe in the quality of their products, and sometimes become important customers. A young man who served as an apprentice with a comparatively small firm later became vice-president of a larger organization. Over a period of eleven years he placed with his original employer an average of $285,000 worth of orders annually.

There are two well-known machine tool plants in New England who have trained apprentices for seventy years. Men trained in these shops may be found today in executive capacities in the machinery industries throughout the country. Invariably they are ardent believers in the products of the companies that trained them; and the fact that they have given such a good account of themselves in the industrial field has in no small degree increased the prestige of the firms in whose shops they learned their trade.

Cheaper Hydrogen for Welding

One of the objections to the use of the atomic hydrogen arc for welding has been the cost of hydrogen. There has been an increasing demand for a cheaper source of gas. This has been met by the development of two processes for supplying a suitable gas for the atomic welding equipment. One is that known as the "ammonia dissociator" process, by means of which gas about half as expensive as ordinary hydrogen may be produced. The other process makes possible the production of Electrolene, which is "cracked" city gas. The equipment for producing Electrolene is more expensive than the ammonia dissociator equipment, but where large quantities of gas are required, the Electrolene producer justifies its higher installation cost, for the gas produced by it costs only about one-half of that obtained by means of the ammonia dissociator. Practically any city gas can be "cracked" to make Electrolene of an analysis suitable for atomic hydrogen arc welding.

Multiple Jig with Unusual Indexing Features

By CHARLES O. HERB

AN ingenious jig is employed in the plant of the Oilgear Co., Milwaukee, Wis., for drilling and reaming a series of five holes around the circumference of castings, one of which is shown at *A*, Fig. 1. The jig might be described as a double indexing fixture, because the work to be drilled is indexed around the horizontal axes of the work-holding arbors and, in addition, the whole fixture is indexed around the vertical axis of the jig itself to bring the work successively in line with each of the three tools that are required to drill and ream each hole.

The jig has five work-holding arbors extending radially from the center, as shown in Fig. 2. The cycle of operations is as follows: The drill head is brought down and five holes, one in each of the five parts, are drilled. Then the work-holding arbors are indexed and the drills again brought down, this being repeated until the five holes in all the five parts have been drilled. Now the jig is indexed one space about its vertical axis and a set of smaller drills performs a second drilling operation by indexing the work-holding arbors as in the first place. When the second drilling operation has been performed in all the five positions around the circumference, the jig body is indexed around its vertical axis a second time, to bring each piece of work beneath a reamer, which finally reams each of the holes by once more indexing the work-holding arbors about their axis.

The castings are made of nickel iron and are cylinders used in high-pressure pumps made by the Oilgear Co. In drilling each hole the second time, tools of the design shown at *B* are used. These tools have a short drilling portion at the lower end and a long pilot that guides the tool in the larger hole drilled in the first step. The reamers finish the larger holes and also square the shoulders produced in drilling the smaller holes.

Indexing of the work pieces on their horizontal axes is done by moving handle *C* 72 degrees around dividing plate *D*. The mechanism is locked in the indexed positions by plunger *E*. Through the use of an "Oilgear" pump and feed cylinder, the drill head is traversed downward rapidly until the tools are about ready to start cutting, then automatically changed to the proper feed for cutting, and finally returned at the rapid traverse rate. Actually, the tools do not rise above the bushing plate.

After the fifth hole in each of the parts has been drilled both the first and second time, plunger *F* is pulled out of engagement with a locating hole in jig body *G*, and the body is turned by hand to bring each piece of work beneath the second drill or the reamer. At the end of the reaming, the jig body is indexed backward to the starting position illustrated in Fig. 1, and the work pieces are removed. Thus body *G* indexes through 40 degrees only.

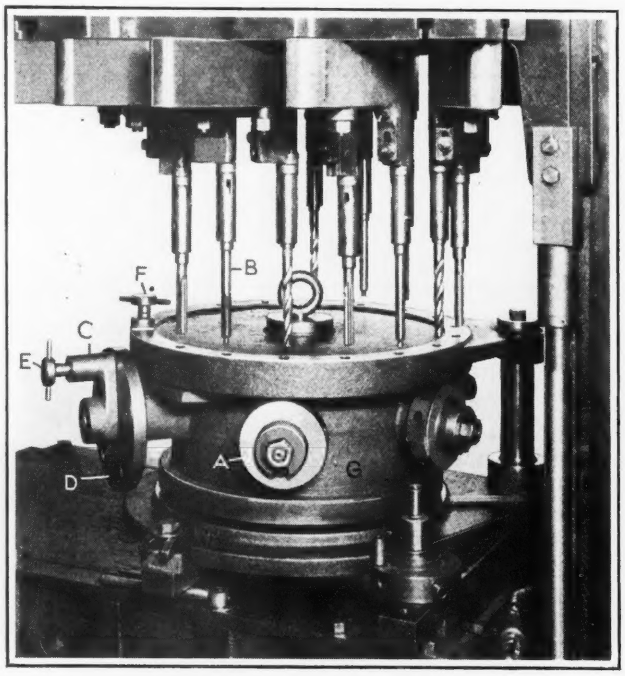


Fig. 1. Jig Having Five Work-arbors that Index on Horizontal Axes while the Body Indexes about a Vertical Axis

With four of the work-holding arbors of the jig in use, as shown in Fig. 1, the production averages sixteen pieces per hour. If the five stations were used, the production would be increased by 25 per cent.

The mechanism by which the work-arbors are indexed simultaneously may be seen in Figs. 2 and 3. Mounted on the inner end of each arbor *H* is a bevel gear *J*. When handle *C* is indexed around the dividing plate *D*, the gear on shaft *K* turns and causes all five gears on the work-arbors to rotate. Although alternate gears and their corresponding work-arbors revolve in opposite directions, this does not matter, since the holes are equally spaced around the work pieces. A coil spring *L* connects shaft *K* with the opposite work-arbor, thus keeping the arbors under tension and eliminating any lost motion between the gear teeth.

The "Oilgear" hydraulic equipment provided on the machine speeds up the production in this operation by reducing the time required for the operation of the drill head to a minimum. Also, in the reaming step, it is necessary for the drill head to feed against a positive stop and dwell there long enough for the tool to clean up the shoulder between holes of different diameters. The length of feed and the period of dwell can be accurately controlled by means of the hydraulic equipment.

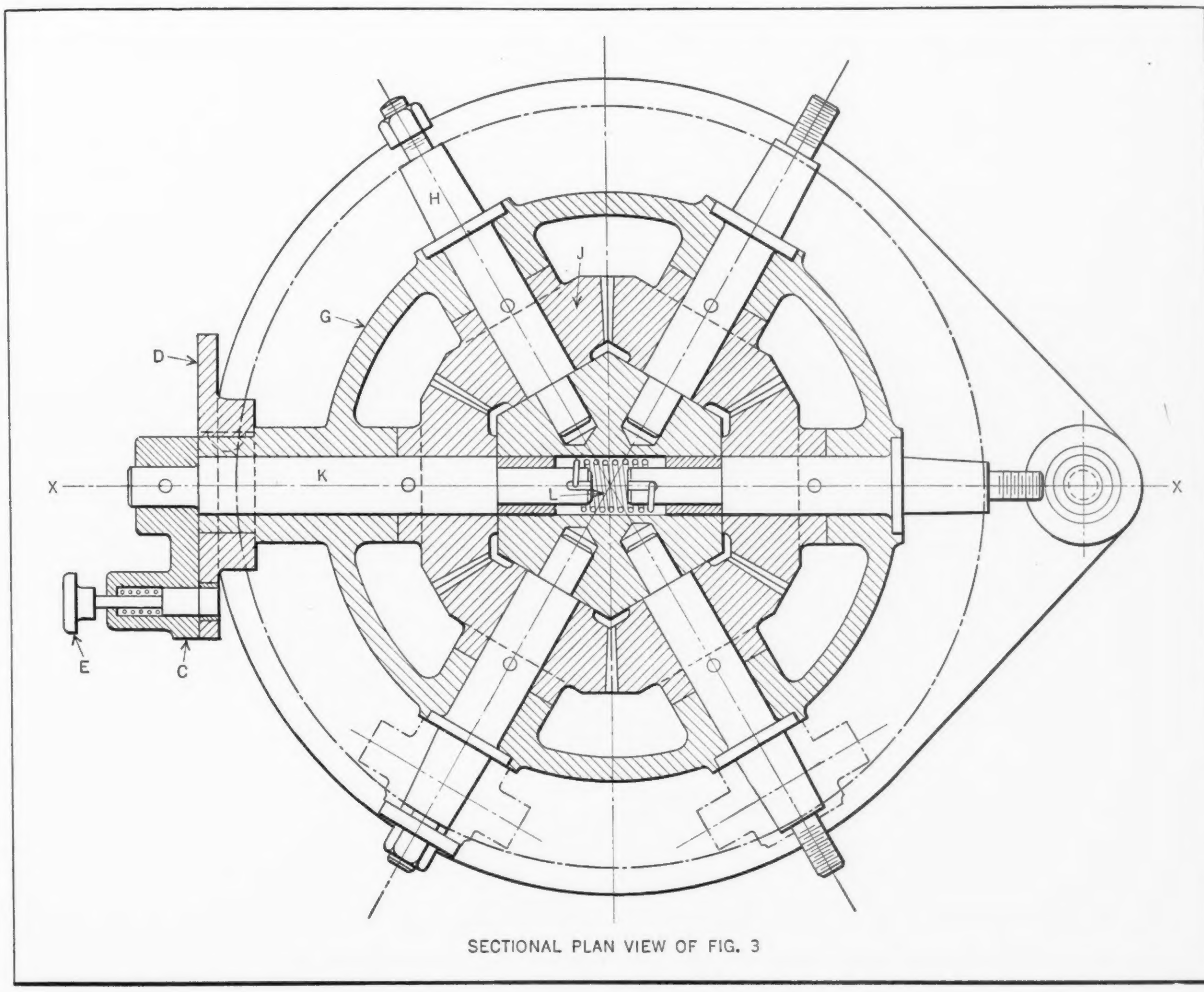


Fig. 2. Sectional View, Showing the Mechanism Used for Indexing the Five Work-arbors of the Jig Illustrated in Fig. 1

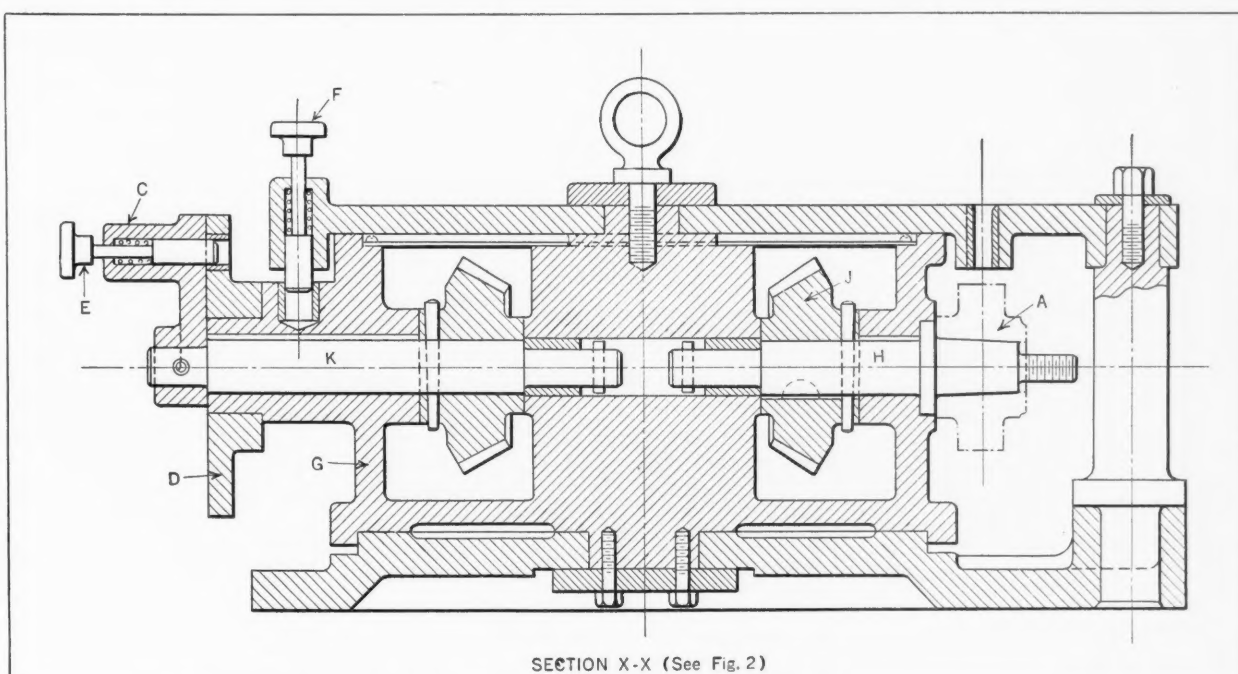


Fig. 3. Another Sectional View of the Jig Shown in Figs. 1 and 2

Riveting Die with Ejecting Mechanism

By H. R. HAGEMAN

SHEET-METAL casings, one of which is shown in Fig. 1, are produced in large quantities from flat blanks. These casings are used for enclosing contacts and insulators for electric appliance plugs. After forming, the ends *A* and *B* are fastened together by means of eyelets formed in the casing during a preceding operation. The mechanism of the die used for heading the eyelets and for automatically ejecting the finished casing will be readily understood by referring to Fig. 3.

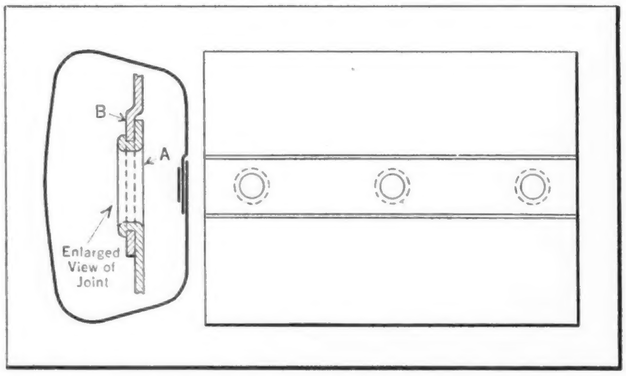


Fig. 1. Sheet-metal Casing Riveted in Die Shown in Fig. 3

The casing, which is indicated by heavy dash lines, is placed over the horn anvil *H:* When the press is tripped, the cams *C* descend, causing the jaws *J* to close in upon the casing, and thus locating the joint properly over the three riveting pins in the horn anvil. At the completion of the downward stroke, the punch *S* is in contact with the entire length of the joint; thus the eyelets are curled or headed over, and the joint is fastened securely.

To prevent deflection of the horn during the riveting operation, a supporting block *D* is provided. This block is slid under the outboard end of the horn by means of the lever *L* which is actuated by the right-hand jaw *J*. The offset *O* on the cams *C* causes the jaws to recede slightly an instant before the eyelets are riveted. This allows the eyelets to locate themselves in the pierced holes in the under side of the lap joint before the punch descends.

In Fig. 2 is shown a cross-section of the ejecting mechanism. The rocker lever *R* is normally held in the position shown by a coil spring which acts against the heel of the lever at *Y*, Fig. 3. The sliding member *X* in Figs. 2 and 3 is connected to lever *R* by the link *Z*. To follow the movements of the ejecting mechanism, reference should be made to the left side of Fig. 3. When the riveting operation is completed and the work is about to be ejected, the sliding jaws *J* are in their farthest position toward the center.

As the cams *C* move upward, the sliding jaws *J* move outward, the jaw at the left carrying with it the pawl *P* which is pivoted on the top of the jaw. The pawl is held against the point of the dog *M* by the spring *K* and its end engages the point of the lever at *T*. As the jaws continue to move outward, the long arm of the lever *R* swings and carries the link *Z* and the sliding member *X* forward. When the sliding jaws approach the end of the outward stroke, the wide portion of the pawl at *W* comes in contact with the point of the dog *M* and disengages lever *R*, allowing it to return to the position shown.

It is obvious that when the casing has been riveted, it must be raised off the riveting pins before it can be ejected. This is accomplished as follows:

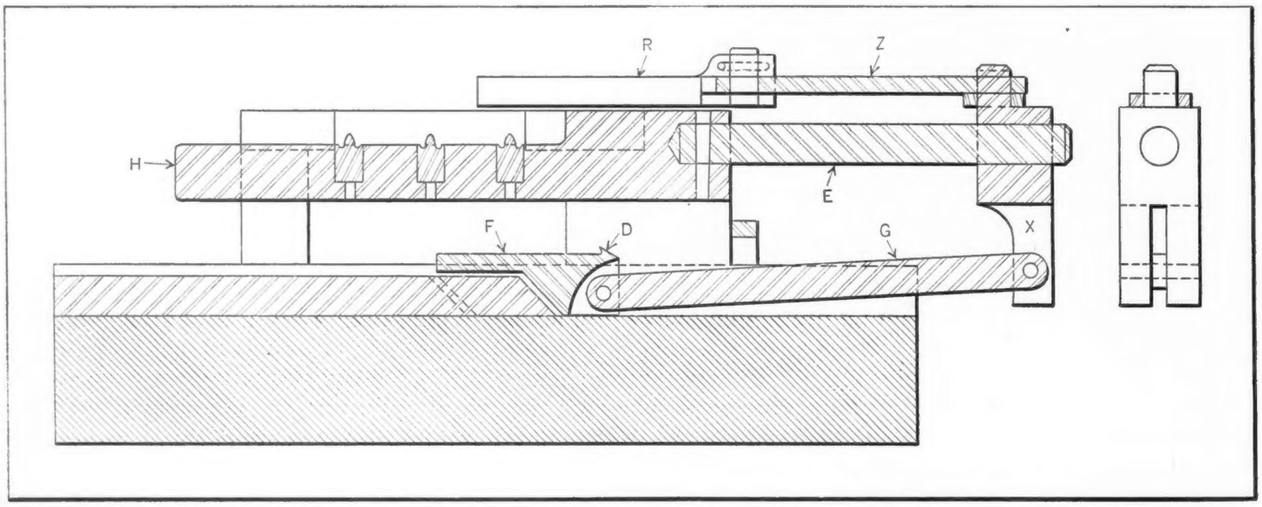


Fig. 2. Section of Die Illustrated in Fig. 3, Showing Ejecting Mechanism

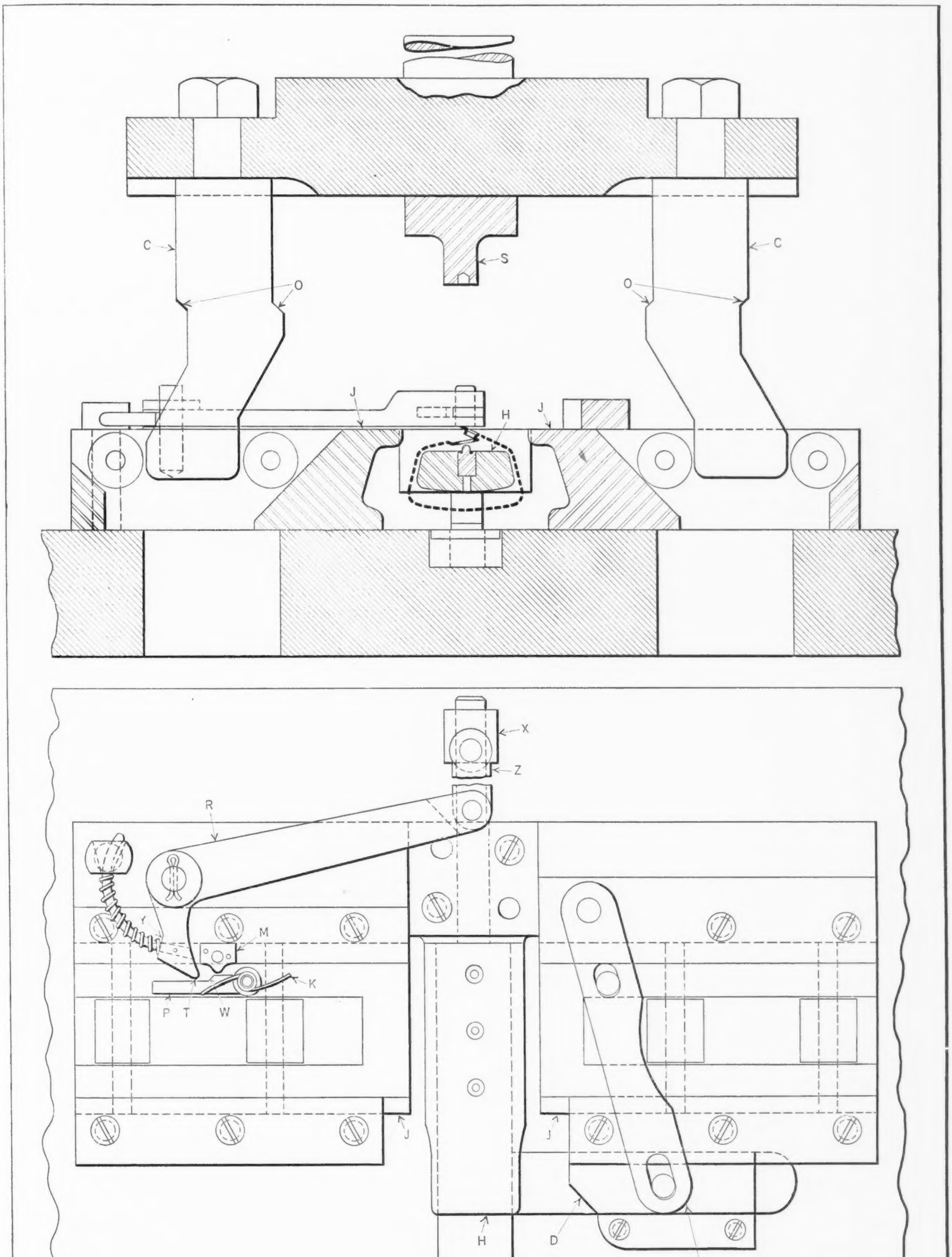


Fig. 3. Die in which Part Shown in Fig. 1 is Riveted and then Automatically Ejected

The sliding member X, which is guided by the rod E, Fig. 2, is connected with a sliding wedge F by the link G. When the sliding member X causes wedge F to slide forward or toward the left, the wedge is also raised vertically to a position parallel with the face of the work. As this movement continues, the wedge lifts the casing off the riveting pins and the small projection D comes in contact with the edge of the casing and moves it forward rapidly, throwing it clear of the bolster plate. The wedge F then returns to the position shown, in order to permit the die to be reloaded.

Formerly, this riveting operation was accomplished in a die similar to the one described, except that the jaws were operated by hand-levers and the riveted piece had to be pulled off the horn with a hook. With this die, about 400 parts per hour was the maximum production, while with the die designed as described in the foregoing, 1000 pieces per hour can be riveted.

Floating Tool-holder for Production Work

Quick-change Tool-holder for Lathe Tailstock that Permits Successive Operations on Light Work to be Performed Rapidly

By PAUL LEO

RAPID production on certain jobs handled in the writer's small experimental shop is obtained by the use of the simple quick-change tool-holder shown at F, Fig. 1. The taper shank P of the holder is made to fit the tailstock spindle of a small lathe, while the straight shank shown at Q can be substituted for the taper shank when it is desired to employ the tool-holder on a turret lathe. This tool-holder is an adaptation of a floating reamer-holder described in April, 1926, MACHINERY, page 633, suitable changes in the design having been made to accommodate lighter or smaller tools and chucks, such as shown at the left, Fig. 1.

At A is shown a chuck for holding straight-shank reamers, drills, counterbores, and similar tools. At B is a friction type tap chuck, and at C, a taper socket for holding tools having tapered shanks. A special reamer is shown at D, while at E is a small die-holder. Any of these or similar tools can be quickly inserted in the holder or removed from it. Thus a variety of drilling, reaming, tapping, counterboring, or similar operations can be performed in rapid succession. The pieces G in holder F, which are held in place by screws H, serve to retain the tool when it is backed away from the cut.

The construction details of the tool-holder are shown in Fig. 2. The shanks P and Q are threaded to fit the body A. Each shank is provided with a hardened and ground thrust button C, which is knurled on the edge to facilitate its removal. The

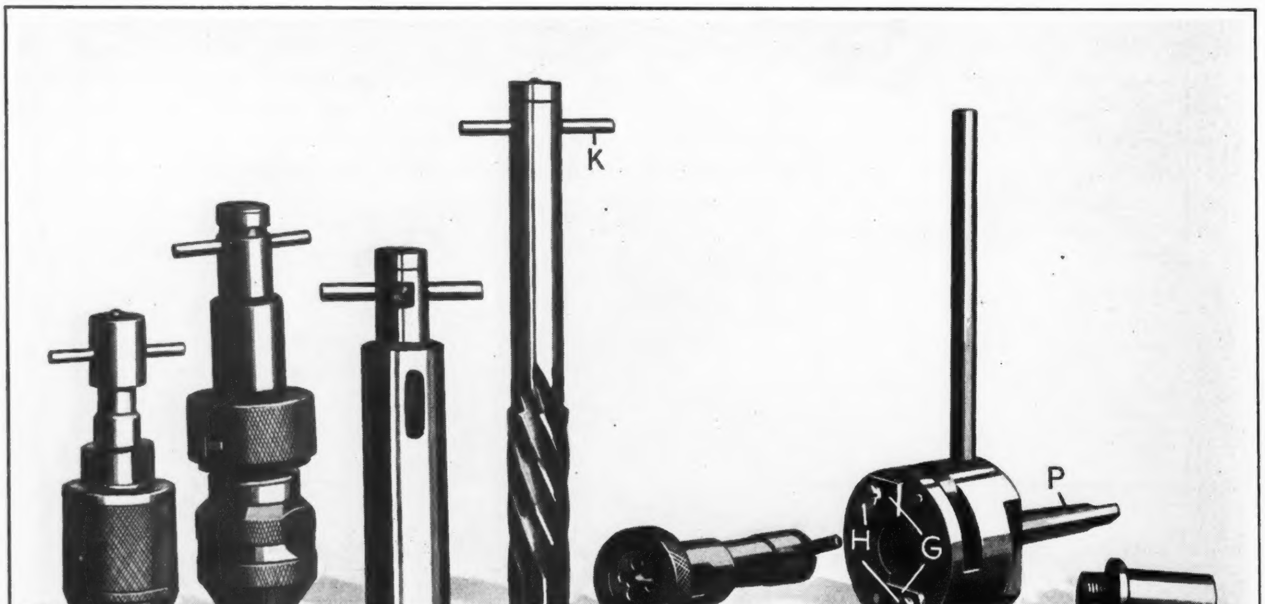


Fig. 1. Quick-change Tool-holder and Some of the Tools and Chucks Used for Light Production Work

recess D milled in body A provides sufficient clearance for the hardened rollers E, which are a running fit on the stationary pins F. These rollers serve as a stop for the pin K, Fig. 1, in the shank of the cutting tool or chuck, preventing it from revolving and yet allowing the tool a sufficient amount of float.

The shank J of a tool or chuck is fitted with a recessed washer M which has a hole through its center about 1/64 inch smaller than the diameter of the steel bearing ball N, for which it serves as a retainer or housing. The retaining washer is made a light press fit on the inner end of the shank. The hole in the washer is chamfered on the inside to an angle of 60 degrees. The outside diameter of the washer is made about 0.010 inch smaller than the diameter of the tool shank.

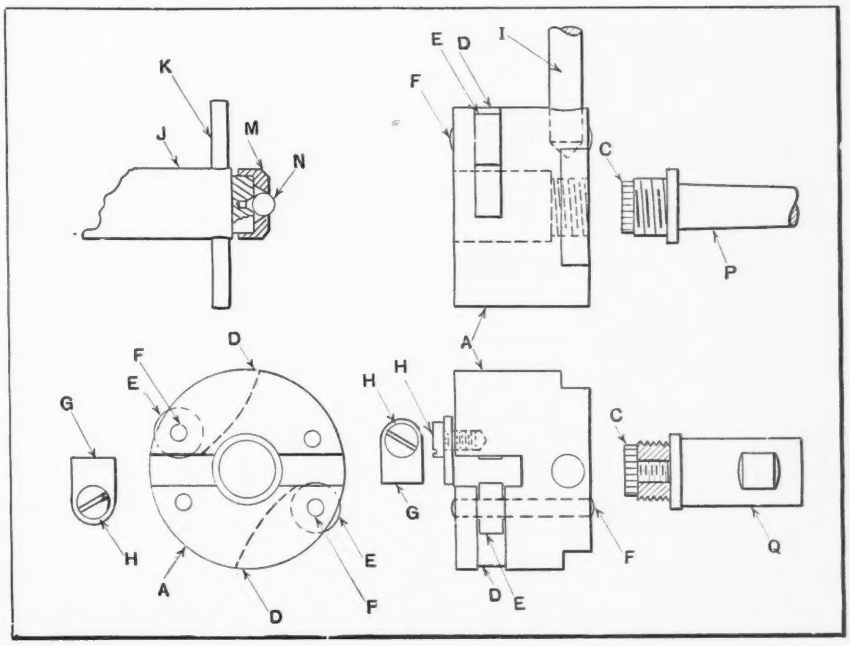


Fig. 2. Details of Quick-change Chuck Shown at F in Fig. 1

With this arrangement, the ball bears against the thrust button C, which takes the thrust resulting from feeding the tool into the work, but at the same time allows a sufficient amount of float to permit the tool to center itself. Greater freedom of movement is allowed the ball end of the tool shank by countersinking the washer M to a greater depth and inserting a thin hardened steel disk between the ball and the countersunk end of the tool shank to give a flat bearing surface.

Trapped Air and Pulling Capacity of Belts

By JOHN E. HYLER

An article in March MACHINERY, page 533, takes exception to the statement that holes in a belt will increase its pulling capacity. Now, while the writer certainly would not advocate cutting holes in a belt, he would like to call attention to the fact that in some types of machinery, particularly high-speed machinery, such as is often found in the woodworking industries, the pulling power of the belt is sometimes diminished by air being trapped between the belt and the pulley. This usually happens when the belt must pass around a small pulley at high speed. Of course, the factor of centrifugal force aggravates this condition.

Manufacturers of woodworking machinery have discovered that there is something to the trapped air contention, as is attested by the fact that most small high-speed pulleys of such machines have grooves in them. Sometimes these grooves run squarely around the pulley, and sometimes they take a spiral direction, being cut both to left and right on a spiral lay-out so that they intersect at short intervals. These are known to the trade as pneumatic pulleys.

A still further development has taken place on certain woodworking machines, one builder of very high-speed machines having designed what he calls a vacuum pulley for use where trouble in this respect is encountered. This pulley is of hollow construction and is fitted with a rather large flange through which there are several circumferential slots. The slots connect with holes which are drilled through the outer part of the pulley where the belt makes contact.

The rotation of the pulley causes evacuation of the air from the slots in the flange, and this sets up a vacuum-like action in the holes of the pulley face. According to the manufacturer, this greatly increases the effectiveness of the service rendered by the pulley. The writer is inclined to believe that in this instance, at least, it has been thoroughly proved that holes drilled in the pulley face increase the efficiency of the belt.

* * *

An industrial building in which 1000 tons of steel will be used is being constructed by the General Electric Co. at its plant at Nela Park, Cleveland, Ohio. Competitive bids were requested for the construction of this building by conventional methods and by arc welding. The arc welding bid was \$2100 (\$2.10 per ton) less than the other bids.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

J. K.—A mechanic engaged in repairing a heavy piece of machinery started to raise it by using a small jack. His foreman came along and directed him to take out the jack and get one of heavier capacity, as the one he was using was too light for the work. The foreman went away, and in direct violation of his orders, the mechanic continued to use the lighter jack. In so doing, he suffered a severe injury, caused solely by his use of the smaller jack. Will his use of the tool in violation of orders prevent him from holding the employer liable for the injury under the Federal Employers' Liability Act?

Answered by Leslie Childs, Attorney at Law
Indianapolis, Ind.

The general rule is that if an injury is caused solely by the negligence of the workman, there can be no recovery under the act named. On the facts stated, it seems clear that the mechanic acted in open violation of the orders of his superior, and without any reason for so doing other than to "have his own way." In the light of this, it is probable that the Court would deny a recovery on the ground that the mechanic alone was to blame for the accident and resulting injury. (284 S.W. 429)

Laying out Arcs Having Large Radii

F. E. J.—Is there some simple and accurate method for laying out circular arcs having large radii when their centers lie outside the range of the drafting-board?

A.—The table "Segments of Circles" on page 72 of MACHINERY'S HANDBOOK provides a simple means of laying out arcs having large radii, and its range covers arcs of any radius and length. This table is based upon an arc having a radius of 1; for any other radius, the length of the arc and the height of the segment, and the length of the chord corresponding to a given angle are found by multiplying the values L, H, and C given in the table by the given radius.

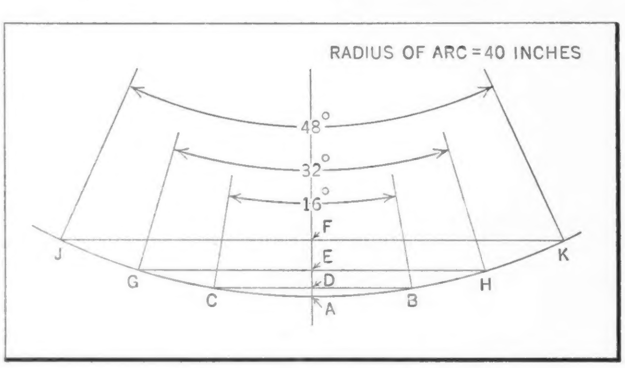


Diagram Illustrating Method of Laying out Arcs Having Large Radii

Suppose that it is required to plot an arc having a radius of 40 inches. First draw a vertical line, as indicated in the illustration, which would pass through the center of the arc. On this line establish a point A through which the arc must pass. From this point measure off a number of segment heights corresponding to angles which increase uniformly in increments of, say, 16 degrees. As already explained, these segment heights are obtained by multiplying the height H given in the table by the given radius, 40 inches. Thus

$$AD = 0.0097 \times 40 = 0.388 \text{ inch}$$
$$AE = 0.0387 \times 40 = 1.548 \text{ inches}$$
$$AF = 0.0865 \times 40 = 3.460 \text{ inches}$$

Now through the points D, E, and F draw the chords CB, GH, and JK perpendicular to and bisected by the vertical line. The lengths of these chords are obtained by multiplying the chord lengths C in the table, corresponding to the angles chosen, by the given radius, 40 inches. Thus

$$CB = 0.278 \times 40 = 11.12 \text{ inches}$$
$$GH = 0.551 \times 40 = 22.04 \text{ inches}$$
$$JK = 0.813 \times 40 = 32.52 \text{ inches}$$

The required arc is now drawn by plotting a curve through the points J, G, C, A, B, H, and K.

Obviously, the accuracy of the arc depends largely upon how close the chords are drawn. It is advisable, therefore, to lay out the chords beginning as near an included angle of 1 degree as is practicable, and advancing in smaller increments than the 16 degrees used simply as an illustration.

Rubber-stamp Signatures

S. P. M.—We operate a large manufacturing business and, as regular subscribers to MACHINERY, we desire some information on the following point of the law: It is customary in our plant, as in a great many other businesses, to supply certain employes with rubber stamps carrying the firm's name to use in endorsing checks, signing contracts, etc. A new employe recently ordered a large quantity of merchandise, signing the firm's name with one of the rubber stamps. We have endeavored to have the seller reduce the quantity of this order, but he refuses to grant the request and threatens suit if we do not accept and pay for the

entire order. We feel that this manufacturer should not compel us to take merchandise which he knows was ordered through the ignorance of an employe.

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

Assuming that the employe who ordered the merchandise was properly authorized to transact this business for the firm, the outcome of this litigation depends solely on the answer to the question: Did the employe intend to bind the firm when he affixed the firm's rubber-stamp signature to the contract? If so, you are liable. In other words, the law is well established that any form of an authorized employe's signature, such as that made with a rubber stamp, typewriter, symbols, initials, and the like, may be enforceable against the employer. In a leading case (53 S. E. 447), the higher Court considered the rights of an employe to bind his employer by indorsing the latter's name with a rubber stamp. The Court said: "Where the name required has been so placed by one having authority to do it and with intent to indorse the instrument, the authorities hold that this is a valid indorsement." (The same opinion was held in the following cases: 69 S. W. 72; 133 S. E. 210; and 128 S. W. 446.)

On the other hand, it is important to know that a party suing on a contract or other instrument signed with a rubber stamp, typewriter, or initials is bound to prove to the satisfaction of the Court that the signature was affixed by the employer or authorized employe with the intention of making a valid contract.

Briefly stated, a rubber-stamp signature is as valid as a pen-written one. The only difference is that the validity of a pen-written signature may be proved by the introduction in Court of the signature itself, whereas the complaining party to a contract signed with a rubber stamp is bound to prove that the signature was affixed by a person having the proper authority to bind the firm.

Checking Acme Threads with a Gear-Tooth Caliper

L. E.—As ordinary thread dimensions are in the plane of the axis, how can I determine the corresponding dimensions measured in a plane perpendicular to the thread, in order to use a gear-tooth caliper for checking the width of an Acme thread at any given depth?

A.—The width of an Acme thread in a plane that is perpendicular or normal to the thread, when the width in the axial plane is known, can be determined by means of the following formulas.

Assume that

W = width in plane of axis at pitch line;
W_1 = width in plane of axis above pitch line;
W_2 = width in plane of axis below pitch line;
N = width in plane normal or perpendicular to the thread;
P = pitch of thread;
a = one-half included thread angle in plane of axis;
b = helix angle of thread measured from plane perpendicular to axis;
S = radial distance from pitch line to point where thread is to be measured.

If the measurement is at the pitch line $W = 1/2P$.

If the measurement is above the pitch line and in an axial plane,

$$W_1 = \left(\frac{P \times \cot a}{4} - S\right) 2 \tan a$$

$$W_2 = P - W_1$$

After determining the width W_1 or W_2 in the axial plane, the corresponding width normal to the thread equals $W_1 \times \cos b$ or $W_2 \times \cos b$.

These formulas may be applied to Acme threads, worm threads, or any angular form.

If a rule is preferred to a formula, proceed as follows: Multiply the pitch of the thread by the cotangent of one-half the included thread angle, divide the product by 4, and subtract from the quotient the radial distance from the pitch line to the point where the thread is to be measured; then multiply this difference by twice the tangent of one-half the thread angle, thus obtaining the width in the plane of the axis. To obtain the width normal to the thread, multiply the width in the plane of the axis by the cosine of the helix angle as measured from a plane perpendicular to the axis.

* * *

Convention of the American Foundrymen's Association

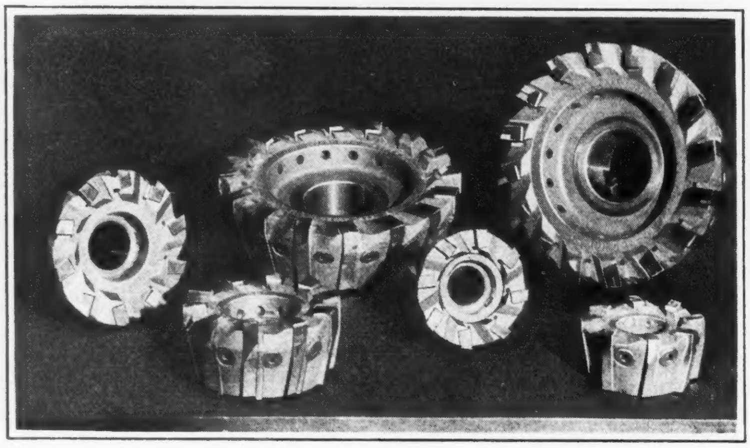
The meeting of the American Foundrymen's Association at the Hotel Stevens, Chicago, Ill., May 4 to 7, proved an event of unusual interest to men in the foundry and allied industries. A great number of papers of interest to gray iron, steel, and non-ferrous metal foundries were presented. The subject of high-test alloy cast iron was given special attention, and sessions were devoted to foundry costs, sand research, and pattern production, as well as to malleable castings. The training of skilled molders and patternmakers was also given adequate attention, the subject being thoroughly discussed by H. S. Falk of the Falk Corporation, Milwaukee, in his paper "Getting a Community Apprenticeship Under Way."

In connection with the meeting, an extensive exhibition of equipment and materials for the foundry and allied industries was staged in the exhibition hall and grand ball room of the Stevens Hotel. This arrangement made it possible for those attending the convention to participate in the meeting and visit the exhibits without leaving the hotel.

* * *

Foreign sales of automobiles built in the United States in 1930 amounted close to 560,000 cars and trucks.

Milling with Tungsten-Carbide and Tantalum-Carbide Cutters*



Successful Methods of Using the New Metals for Milling Cutters have been Developed and Cutters of this Kind are Now Used by Many Manufacturers

By FRANK W. CURTIS, Research Engineer,
Kearney & Trecker Corporation, Milwaukee, Wis.

IT is only recently that milling cutters made from tungsten carbide have been applied successfully. The earlier efforts to employ this cutting material in milling cutters were not successful, because attempts were made to employ conventional cutter designs and to use the cutters in machines that were not sufficiently rigid.

Recently, however, it has been demonstrated that tungsten carbide can be used for milling with satisfactory results. Success in the application of this material depends, however, entirely on rigidity—rigidity in the cutter, in the machine, and in the fixture. The importance of rigidity cannot be over-emphasized.

Milling cutters of the inserted-blade type can be designed so that the full benefits of tungsten carbide may be realized. Several cutters that have proved satisfactory for milling practically all kinds of metals are shown in the heading illustration. These cutters are used to remove from 1/16 to 3/16 inch of metal. On cast iron, feeds of 50 inches per minute and more may be used; on bronze, up to 75 inches per minute; and on aluminum, up to 100 inches per minute. The outstanding advantage of these cutters is the fact that the blades may be replaced, so that if the tungsten-carbide insert in one of the teeth should become damaged, a new blade can be substituted without affecting the other blades.

Cutters having the inserts brazed solidly in a steel body—corresponding to ordinary plain and side-milling cutters and end-mills—have been used successfully, although their application is somewhat limited. The replacement of a damaged insert becomes more of a problem in this type of cutter, as the high temperature required for rebrazing a new tip in place has a tendency to loosen the other tips. On this account it is often necessary to rebuild a cutter of this kind completely when one of the tips becomes damaged.

In some cases, it is possible to construct a cutter with tipped steel blades which are welded in place in the body. The small steel blade is first milled to receive the tip, which is brazed to it; then the cutter body is slotted to receive the blades, which are pressed into position and tack-welded to the body. After this, the cutter is finish-ground. It is possible to remove these blades without much difficulty, so that they may be replaced, if necessary. Fig. 2 indicates the method used for making cutters of this kind.

Since so much depends upon rigidity, it is highly essential that a milling cutter be designed so that

Fig. 1. Milling Forged-steel Gear Blanks with Tantalum-carbide Cutters

*Abstract of a paper presented before the Production Meeting of the Society of Automotive Engineers held in Milwaukee May 7 and 8.

the tungsten-carbide blades are supported as close to the cutting edges as possible. The traditional practice of extending the blades beyond the face of the body is not suitable when the new cutting metals are used. The overhang causes vibration, which seriously affects the life of the tungsten-carbide tip.

No attempt should be made to equip old cutter bodies with tungsten-carbide blades. When this is done, failure to obtain satisfactory results in operation causes the new cutting metal to be condemned, whereas the failure is due simply to a poor adaptation of the metal.

The blades must be locked very firmly in the body. Individual clamps or wedges for each blade should be used. It is advisable to back up the blades so that they cannot push away from the cut. This backing-up may be provided for in different ways: a backing-up plate forming a support for the back end of the blade may be used or pins may be inserted in the body and slots cut in the blade to provide this support.

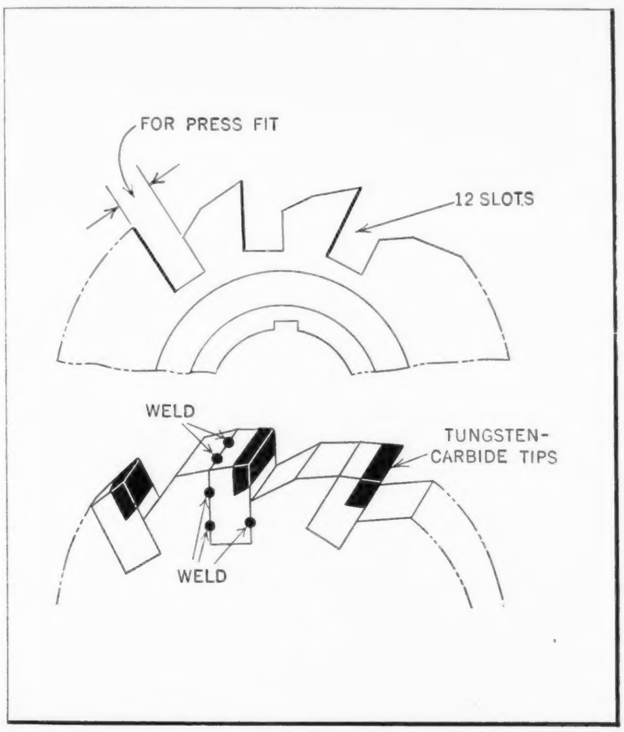


Fig. 2. Design of Cutters Having Blades that are Tack-welded to the Body

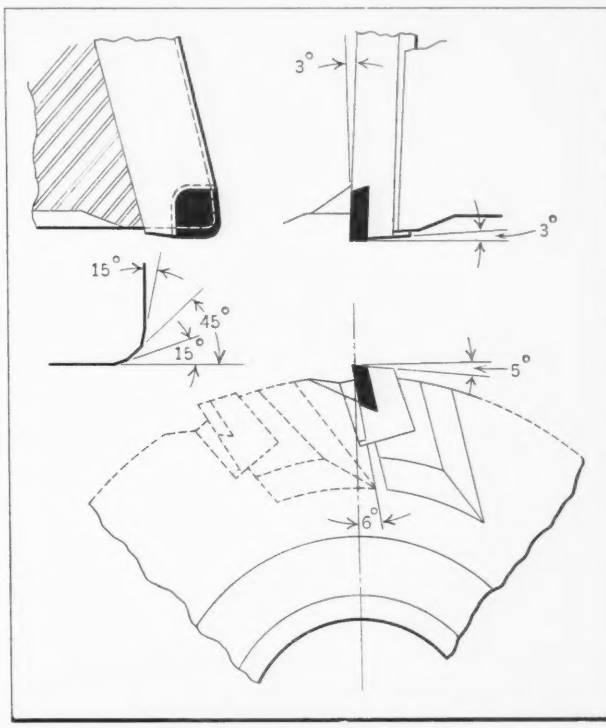


Fig. 3. Face, Rake, and Clearance Angles on Cutters for Milling Cast Iron

The Machine in which Tungsten-carbide Cutters are Used is as Important as the Cutters Themselves

There is such a contrast between the speeds and feeds used with tungsten-carbide milling cutters and those used with cutters of earlier types that milling machines of the older types are not adequate for the cutters made of the new metals. They do not have the necessary strength and rigidity. Milling machines recently placed on the market, however, have the required rigidity and strength, and are provided with suitable speeds and feeds for the new cutting metals. If a machine of recent design, although not built especially for the use of tungsten-carbide tools, is in perfect condition and appears to be suitable for the new cutters, it might be tried; but if it develops any tendency to chatter, the experiment should be stopped immediately. It is evident that satisfactory results cannot be obtained with it.

All in all, there is so much to be gained by using machines designed specifically for tungsten-carbide operation that it is merely a makeshift to use older types of machines. From the standpoint of both economy and production, machines suited to the new cutting metals should be used.

The question is often raised as to whether or not more power is required for the use of tungsten-carbide milling cutters. The answer is decidedly "yes." When the speed of the spindle is increased, the power increases with it. Just how much more power is required depends, of course, on many conditions aside from the speed, as the feed and the depth of cut must also be considered. In general, however, machines suitable for the new cutting tools should have ample power in order to permit them to be used to their full capacity.

A Smaller Allowance for Finishing Castings may be Made when Tungsten-carbide Cutters are Used

Tungsten carbide has very little respect for the average scale of a casting—the scale is machined almost as easily as the inner metal. This is due to the extreme hardness of tungsten carbide. Hence machining allowances can be changed considerably.

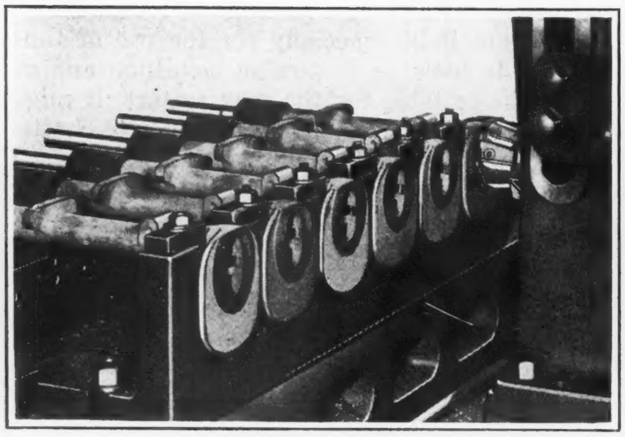


Fig. 4. Milling Cast-iron Pump Bodies at a Surface Speed of 280 Feet per Minute

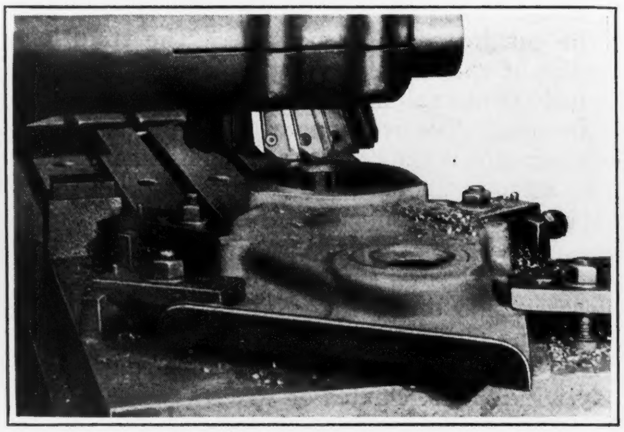


Fig. 5. Milling Cast-iron Chain Covers with a Feed of 26 Inches per Minute

Where formerly an allowance of from 1/8 to 1/4 inch was provided on the surface of a casting for machining, an allowance of 1/16 to 1/8 inch is sufficient. The greater allowance in the past was necessary in order to permit the cutting edges to get beneath the scale. This is not necessary when tungsten-carbide cutters are used. Patterns, therefore, should be changed if the full benefits of tungsten-carbide tools are to be realized. . In this way, material can be saved, the power required for machining reduced, and the speed of machining increased, as the feed per minute may be greater. In one case, by reducing the machining allowance, the feed was more than doubled, and yet the power required for finishing was not increased. This example is typical of many milling operations.

To obtain the full value from tungsten-carbide milling cutters, it appears that better control of the output of many foundries will be necessary. Uniformity in the size of castings has always been important for economical production, but it is far more important with the new cutting tools than formerly, because one of the chief economies derived from them is the small allowance required for finishing.

There is Less Distortion of the Castings when the New Cutters are Used

In addition to faster milling, there are other advantages to be gained by the use of the new cutters. Accuracy, for example, need not be sacrificed; on the other hand, it may be increased. Cutting pressures are usually reduced, with the result that closer tolerances may be maintained. The higher speeds at which the new cutters operate frequently permit a higher finish to be obtained.

Many tests have shown that there is less distortion in the castings being milled when tungsten-carbide milling cutters are used than when cutters that must operate at slower speeds are employed. Thin frail castings and parts that usually require limited feeds are not subjected to the same pressures when being milled at the higher speeds. Furthermore, less heat is generated on the face of the surface being milled. This is especially noticeable in machining materials that are cut dry.

The higher speeds of tungsten-carbide milling cutters also lessen the danger of the edges or corners of castings being chipped or broken away. There are also economies due to the possibility of combining roughing and finishing operations in one cut.

The new cutters, properly applied, have a greater life between grinds than cutters formerly used. While there is no definite rule, experience has shown that these cutters will mill from two to ten times as many parts between grinds as cutters made from materials formerly used. The reduction in cutter set-ups on a long run results in a marked gain in output.

The Effect of the New Cutters on Milling Fixture Design

Changes in present methods of milling fixture design will accompany the use of tungsten-carbide cutters. Improved clamping methods are necessary. Quick-operating clamping devices are essential to reduce the loading and unloading time, because, if the time required for operating the fixture is not reduced in proportion to the reduced machining time, half the advantage of the new cutters is lost.

In many cases, present fixtures cannot be used advantageously with tungsten-carbide cutters, and new fixtures should be provided. Sometimes old fixtures will give satisfactory results if they are equipped with quick-operating clamps. The main consideration is to provide an unusual degree of rigidity. Older fixtures seldom have the strength required for milling with the new cutters.

Cutting Angles for Tungsten-carbide Milling Cutters

Experience has shown that the rake and clearance angles for tungsten-carbide turning tools should be reduced slightly, as compared with the conventional angles suitable for high-speed steel tools. The same is true for milling cutters. Fig. 3 shows a typical cutter design for machining soft or

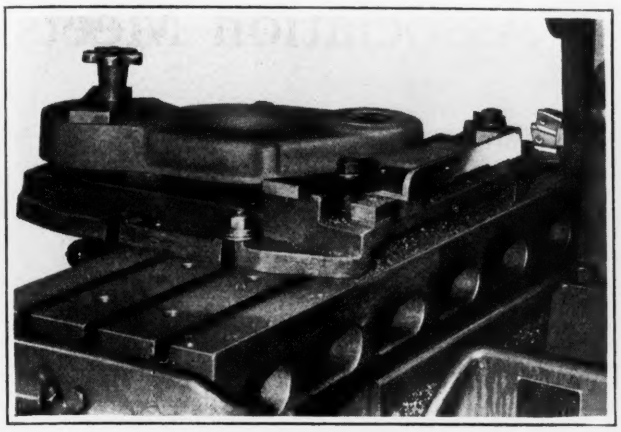


Fig. 6. Milling Gear-case Cover Faces, over 12 Inches Long, in 30 Seconds

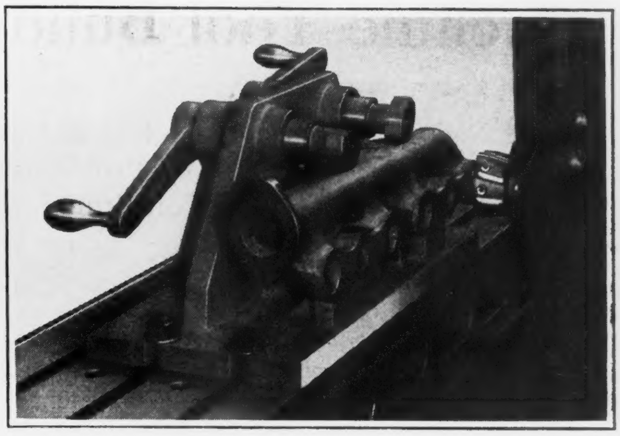


Fig. 7. Milling Small Manifolds with a Feed of 52 Inches per Minute

medium-hard cast iron. The face angle is 6 degrees, the rake angle 3 degrees, and the bottom clearance 3 degrees. The angle on the periphery should be sufficient to clear the work, so that the heel of the blade will not drag. Usually, 5 degrees is satisfactory.

These angles may be altered slightly one way or the other without seriously affecting the cutting efficiency, the life between grinds, or the power consumption. For example, reducing the rake angle to 1 degree and increasing the face angle to 8 degrees has not caused any material change. However, the angles shown have proved most successful in general use.

The angles shown in Fig. 3 can also be used successfully for milling malleable iron. Aluminum and yellow brass require greater face angles. Satisfactory designs for these materials call for a rake angle of 3 degrees and a face angle of from 10 to 15 degrees. The bottom clearance angle for brass should be 4 or 5 degrees, and for aluminum, 5 or 6 degrees.

Tantalum-carbide Cutters Have Proved Very Satisfactory for Milling Steel

For milling steel, tantalum-carbide cutters have proved satisfactory. Based upon tests conducted up to the present time, it is possible to increase the speeds and feeds about 100 per cent, as compared with high-speed steel cutters. Tantalum-carbide cutters have been run successfully at speeds of from 140 to 160 feet per minute, with a feed of 12 inches per minute.

Fig. 1 shows a set-up for milling forged-steel gear blanks made from S.A.E. 3140 steel with tantalum-carbide cutters. One-sixteenth inch of material is removed on each side. The steel is tough and hard, and ordinarily would be machined at 75 feet per minute, with a feed of 6 1/2 inches. With tantalum-carbide cutters, the speed used is 170 feet per minute and the feed, 14 inches per minute.

Fig. 4 shows a set-up for milling cast-iron pump bodies. The fixture holds six pieces. The surface milled must be held to close limits, and the finish must be smooth. A 3-inch tungsten-carbide cutter is used at a speed of 280 feet per minute and a feed of 32.5 inches per minute; the depth of cut is from 1/16 to 3/32 inch, and the cutting time for the six pieces is 42 seconds.

A set-up for milling cast-iron chain covers is shown in Fig. 5. A 9-inch tungsten-carbide cutter is used, operated at a speed of 288 feet per minute, with a feed of 26 inches per minute and a depth of cut of 1/8 inch. The actual cutting time per piece is 20 seconds. The finish allowance could be reduced to 1/16 or 3/32 inch. On this basis, the feed could be increased to 40 inches per minute.

Fig. 6 shows a set-up for milling the jointed face of a gear-case cover. A tungsten-carbide cutter 3 inches in diameter is used at a speed of 280 feet per minute, with a feed of 26 inches per minute and a depth of cut of 1/8 inch. The face being machined is approximately 1 1/2 inches wide by 12 3/4 inches long. The total cutting time per piece is 30 seconds. By reducing the finish allowance on the face to 1/16 inch, the table feed can be increased to 42 inches per minute.

Fig. 7 shows a set-up for milling small manifolds with a 3-inch cutter. In less than 30 seconds, the face of the manifold is milled with a feed of 52 inches per minute and a depth of cut of 1/16 inch.

* * *

New Developments in Casehardening Methods

In a paper read before the Production Meeting of the Society of Automotive Engineers, held at Milwaukee, May 7 and 8, H. E. Koch of the Research Department of the Hevi Duty Electric Co., reviewed the advances that have been made in furnaces for casehardening and nitriding. He described recent designs of such furnaces, and outlined the cycle of operations in nitriding or casehardening work in a new vertical type of electric furnace or carburizer. Comparative cost figures were also presented, and a chemical mixture or gas known as "Carbonal," which is used for the process, was referred to.

Machine Tool Builders' Association Meets

Present Business Conditions and the Problems Created by Them Constituted the Main Subjects for Discussion

THE National Machine Tool Builders' Association held its annual spring meeting at Old Point Comfort, Va., May 18 and 19. The many problems of the industry arising mainly from the present business depression were discussed in great detail. In his opening address, the president of the Association, Carl A. Johnson, president of the Gisholt Machine Co., Madison, Wis., briefly reviewed the present state of the industry, pointing out that the lowest point of the business cycle curve appears to have been passed some months ago.

The Need for a General Machinery Trade Association is Emphasized

Mr. Johnson further pointed out the need for a general machinery builders' association in the United States—an association that would sponsor the interests of the entire machinery-building industry, in which some 10,000 manufacturers throughout the country are engaged. He also called attention to the great number of old machines used in every line of manufacture—machines that are no longer suitable for production, because they waste time and labor, as compared with machines that have been brought out during recent years. This applies not only to the machine shop and metal-working industries, but to practically all other industries as well. Old looms are used in textile plants, old woodworking machinery in furniture factories, and so forth.

The general manager of the Association, Ernest F. DuBrul, in his report to the membership, also reviewed in considerable detail the conditions in the industry as indicated by the statistical service maintained by the Association. He pointed out that in times of depression there is danger of adopting trade practices that impair the high standard for which the machine tool industry is known throughout the machinery field. He warned against permitting unscrupulous buyers to influence manufacturers in adopting practices that are harmful to the industry as a whole, and pointed out that the real test of the business standards of the industry is a period of depression like the one that we are passing through.

The Growth of Large Corporations

One of the important parts of the report of Mr. DuBrul dealt with the increasing concentration of industry in the hands of a few large corporations. There are, in American industry, about two hundred very large corporations with gross assets of over $80,000,000 each. "There are none of these large corporations in the machine tool industry," said Mr. DuBrul. "If the capital of the whole machine tool industry were put together, it probably would just about make up one or two of the smaller of these large corporations."

Mr. DuBrul further pointed out that, as the management of these large corporations is in the hands of a comparatively small number of men, these few men are vested with a tremendous economic power—a force that may either benefit or harm a multitude of individuals and, in fact, may affect whole industries. It can shift the currents of trade, bringing prosperity to one community and ruining another. However, it is gratifying to note that the executives of these large corporations, in growing numbers, recognize their responsibilities.

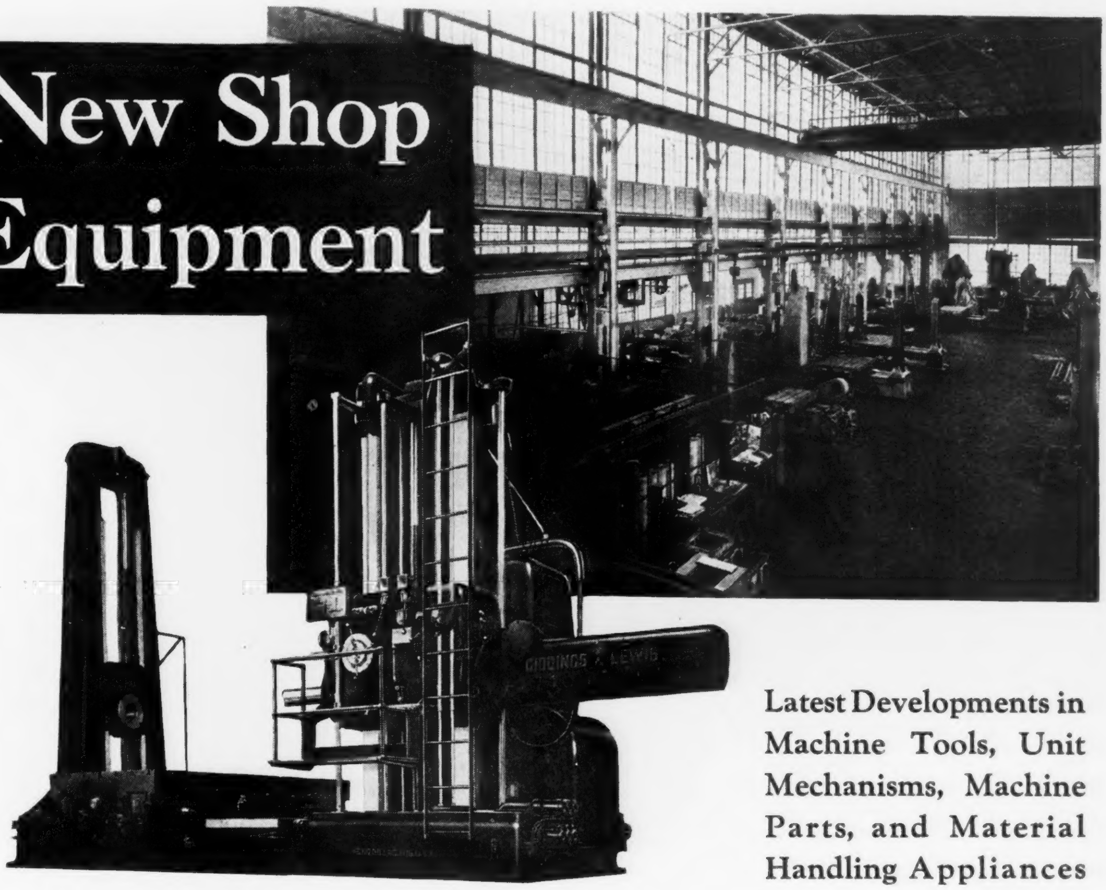
The labor policies, the price policies, and the purchasing policies of these large corporations are of the utmost importance to every American. "Consider, for instance, the employment question," said Mr. DuBrul. "These two hundred corporations employ or influence the employment of at least half the wage earners of the country." About thirty of these large corporations are engaged in metal production and fabrication and, therefore, have an important influence on the machine tool industry. If they buy heavily during industrial booms only, and completely cease buying when business is quiet, they force the machine tool industry, in turn, to lay off its workmen and partially close its plants.

It is likely that market research might show that the large corporations using metal-working machinery during the last five years have bought more than one-half of the machine tools manufactured. While it is known that the demand for machine tools is highly irregular, market research might show which customers are the main factors in causing this irregularity. With such facts in hand, the industry will be able to show the executives of large corporations that their very size imposes an obligation on them to do long-term planning.

An Inquiry into the Effects of Old Machinery is Needed in All Industries

Following Mr. DuBrul's report, Earl Whitehorne, assistant vice-president of the McGraw-Hill Publishing Co., presented a progress report on a plan for equipment modernization for all industries, the purpose of which is to stimulate the replacement of old equipment with more efficient machinery, and especially to urge that such replacement be made in times of dull business. This would result in two-fold benefits—first, it would make it possible for those re-equipping their plants to do so at a time when there would be the least interference with production work; and second, it would aid in equalizing employment over busy and dull periods.

New Shop Equipment



Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts, and Material Handling Appliances

Giddings & Lewis Two-Spindle Horizontal Boring, Drilling, and Milling Machine

Two spindles—the conventional main spindle and an auxiliary high-speed spindle—comprise one of the important new features of the No. 70 high-power precision horizontal boring, drilling, and milling machine recently added to the line built by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

The main spindle of the machine is 7 inches in diameter, and has thirty-six speeds in geometrical progression within the customary range for a machine of its size. The auxiliary high-speed spindle is 4 inches in diameter, and has thirty-six additional speeds with a range four times that of the main spindle. The combined speed range of the two spindles is from 3 to 720 revolutions per minute. Smooth, quiet running of the spindles is insured by gears of the herringbone type and preloaded combination radial and thrust ball bearings.

The speed and feed mechanism for the spindles is compactly built within the enclosed head. The thirty-six speed changes of either spindle are controlled through two levers conveniently located. Each lever has an indicator that facilitates the selection of the desired speed.

Eighteen feeds are obtainable for either spindle through a unit attached to one of the front cover plates of the head. By removing this plate, the complete feed unit can be taken out for inspection. A rotary gear-change lever controls nine feed changes and indicates on a dial the feed applying at any time. The other nine feeds are controlled by a back-gear lever connected to the rotary gear-change lever. Pick-off gears incorporated in the feed-gear train provide for obtaining any desired positive lead. Through a handwheel on the head a slow hand feed is available for either the main spindle or the auxiliary spindle.

The spindles are fed by racks and pinions. The racks have a loose tooth at each end which safeguards the travel of the spindles in either direction. With this type of safety provision, reversal of the spindle feed brings the rack back into mesh. The feed is applied by pulling out the quick-motion turnstile handles. An automatic depth gage, applicable to either spindle, can be set to throw out the feed automatically at any point within a 3-inch travel on the main spindle and a 6-inch travel on the auxiliary spindle.

A spindle selector lever controls the operation of the spindles. When the speed and feed mechanism is connected to the high-speed spindle, this lever keeps the main spindle from

coasting. Either spindle may be clamped in any required position for milling.

The entire head is lubricated automatically by a pump which delivers oil to a distributor at the top of the head, from which it is directed over the inside of the head to all running parts. The spindle ball bearings, as well as the sliding ways of the head, are lubricated by wicks from this distributor. An operator's platform is attached to the head.

The column for the head is unusually massive, weighing approximately 18,000 pounds. It is ribbed in both directions on the inside to offer a stiff support for heavy milling, even at the extreme position of the head. A counterweight for the head is within the column. The column seats on a base which contains the main driving clutches for starting, stopping, and reversing the machine. Within this base there is also a complete milling feed unit, which provides eighteen feeds and a rapid traverse for all units of the machine. In this way, feeds, in inches per minute, are available for milling independently of the boring and drilling spindle feeds.

Changing of the milling feeds is accomplished through a back-gear lever and a rotary lever mounted on the head of the machine close to the spindle feed-change levers. The direction of the feed to each unit is controlled independently, so that the feed can be applied to more than one unit simultaneously in either direction. This is especially advantageous in profile milling.

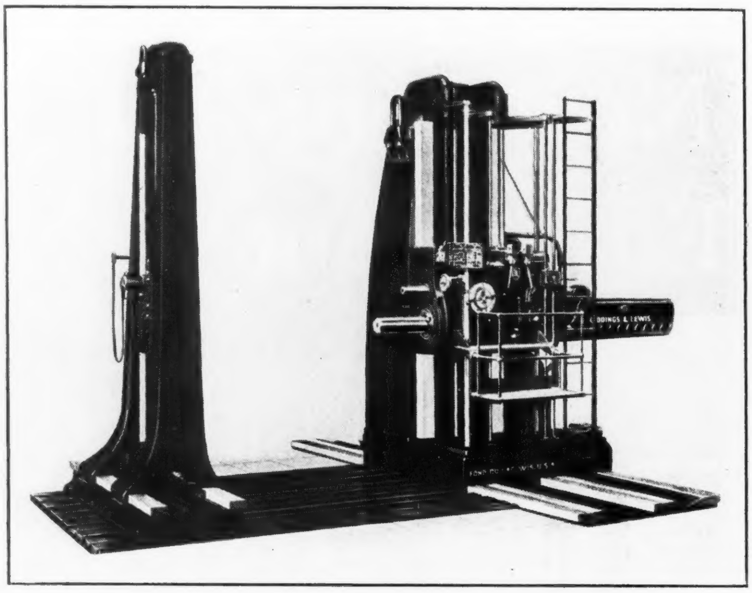


Fig. 2. All Three Types of this Machine Have a Complete Electrical Control from a Panel on the Head

Another important development in this line of machines is the electrical control, which is concentrated in a small panel at the upper left-hand corner of the head. Through push-buttons on this panel the driving motor is started and stopped; the machine itself is started, stopped, and reversed; the feed or rapid traverse is applied to any unit in either direction; and any or all units can be clamped in any position. Small colored lights on this panel indicate at a glance what units are clamped and also what parts of the machine are working. All electrical contactors for this control, as well as the driving motor, are compactly arranged in a compartment on the outside of the column. Cast-iron guards with ventilator doors permit inspection and adjustment.

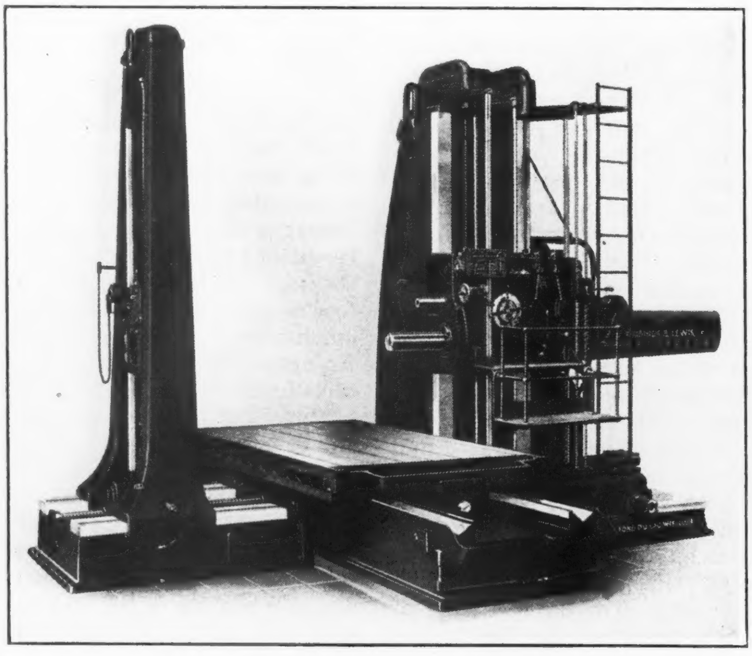


Fig. 1. Giddings & Lewis Planer-type Boring, Drilling, and Milling Machine with an Auxiliary High-speed Spindle

The heading illustration shows a table-type machine weighing about 115,000 pounds. Figs. 1 and 2 show, respectively, planer- and floor-type machines weighing 180,000 and 150,000 pounds. For all three types, the same head, column, column-base mechanism and end support are used. On the table and planer types, a heavy box table is used, which has a large number of reamed stop-holes in the top and T-slots that run the full length. On the table and planer types, the end support block moves in unison

with the head. On the planer type, the head, column, and column-base mechanism are movable along a runway at right angles to the travel of the table, which gives this machine the production advantages and conveniences of the table type.

Additional specifications are as follows: Range of main spindle feeds per revolution of spindle, from 0.005 to 0.250 inch; range of auxiliary spindle feeds per revolution of spindle, from 0.002 to 0.125 inch; rate of traverse to all units, 120 inches per minute, and horsepower required, 40.

As far as the range of the machines is concerned, a wide selection is available in the size and travel of the different units. The vertical adjustment of the head on the column is 144 inches on all types. The maximum distance between the spindle nose and end support on the table-type machine can be made as long as required, with tables up to 72 by 144 inches. On the planer type, practically any size of table can be furnished. On the floor type, the travel of the column on the runway and the width and length of the floor plate can be made to suit requirements.

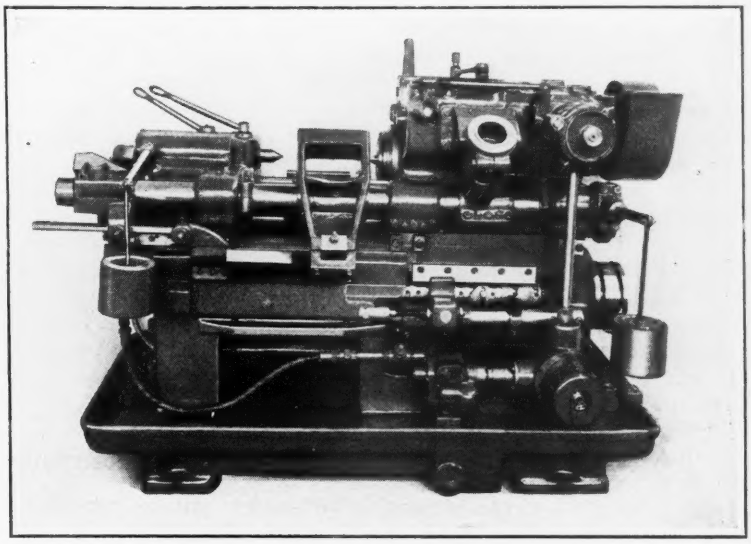


Fig. 2. Rear View of Fay Automatic Equipped with Bevel Attachment

Fay 12-Inch Automatic Lathe

A Fay automatic lathe designed for economical operation in continuous production or in small-lot manufacturing when several sizes and types of parts make up a machine load has been added to the line built by the Jones & Lamson Machine Co., Springfield, Vt. This machine can be set up quickly for different work. Its universal camming, standard tool-blocks, wide range of speeds and feeds, and multiple tooling possibilities adapt it for various types of work held between centers or in a chuck.

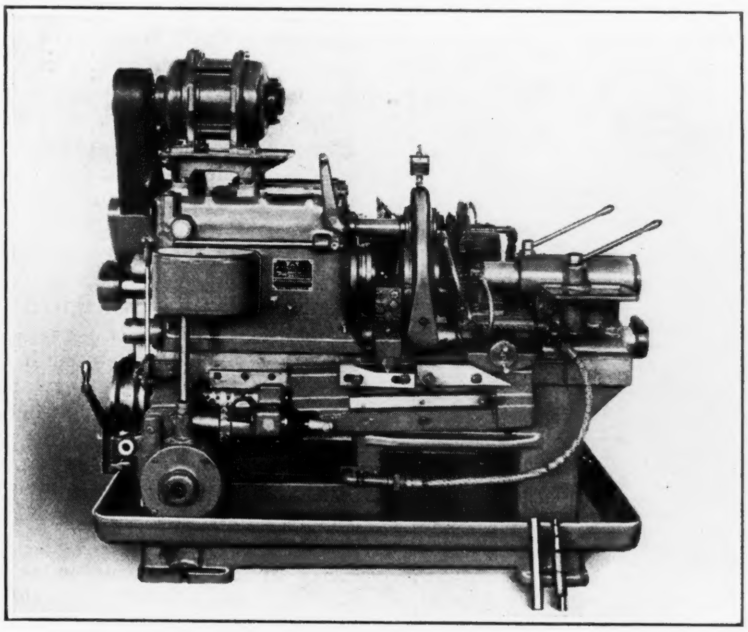


Fig. 1. Fay Automatic Lathe of Smaller Size, with Chip Guards Removed

Figs. 1 and 2 show front and rear views, respectively, of the machine with the chip guards removed. In Fig. 1, the machine is shown equipped with a center-drive attachment for turning, facing, and necking both ends of an automobile transmission shaft at one setting.

Fig. 2 shows the method of mounting the bevel attachment, as well as the method of operating the auxiliary facing attachment from the back bar. The machine is built in four different bed lengths, which give a distance between centers of 15, 21, 33, and 45 inches. The swing over the center bar is 13 1/4 inches, and over the carriage, 10 1/2 inches.

Except for size, this machine follows the general construction of the 14- and 24-inch series built by the same concern. The larger of these machines was described in MACHINERY, May, 1929, page 697. New features in the 12-inch size include the pro-

vision of ball bearings for all transmission shafts and for the work-spindle. Eight spindle speeds can be obtained by changing two pick-off gears. With the main drive pulley running at 1000 revolutions per minute, the standard speeds range from 56 to 377 revolutions per minute, but a spindle speed as high as 1800 revolutions per minute is obtainable.

The bed and chip pan are cast integral to add to the rigidity of the machine and conserve space. The main cam-drum is carried within the bed casting, and all cams are mounted on the outside of the drum. On machines having a length between centers of 21, 33, and 45 inches, an additional cam-drum under the tailstock makes it possible to increase the movements of the various attachments that can be supplied. The quick-return motion has a positive drive from the main transmission shaft and multiple disk clutch. There is a direct connection between the coolant pump and the main-drive mechanism through an Oldham coupling.

As in the previous machines, the front carriage or turning member is supported at the center of the lathe by a heavy ground bar which is held in four bearings in the headstock and tailstock. The outer end of the carriage rests on a former that is mounted on a slide gibbed to the front of the bed. Both the center bar and former slide are moved longitudinally by drum cams. The back arm or facing member of the machine is mounted on a ground steel bar which is held in three adjustable bearings in the headstock and tailstock. The lower end of the back arm operates against the side cam, or former, on a rear former slide.

Nine feeds are available through five sets of change-gears, the carriage or turning feeds ranging from 0.008 to 0.062 inch per spindle revolution, and the back arm or facing feeds from 0.008 to 0.056 inch per spindle revolution. The weight of this machine in the different bed lengths ranges from about 4800 to 6530 pounds. Any constant-speed motor of from 5 to 20 horsepower, depending upon requirements, may be used with this machine.

Milwaukee Duplex Milling Machine

A duplex milling machine of the production type, with spindle speeds up to 1000 revolutions per minute and table feeds up to 100 inches per minute, is being placed on the market by the Kearney & Trecker Corporation, Milwaukee, Wis. This machine is constructed especially for the use of tungsten-carbide and tantalum-carbide milling cutters, strength and rigidity being provided throughout the design so that the higher speeds and faster feeds possible with these cutting alloys can be used. The machine is illustrated in Fig. 1.

Three speed ranges are available—15 to 150 revolutions per minute, 30 to 300 revolutions per minute, and 100 to 1000 revolutions per minute. Twelve speed changes are available in each range. The speeds of each spindle are obtained independently so that cutters of different sizes can be used. In addition, it is possible to provide one spindle with one of the three speed ranges and the other spindle with one of the other two speed ranges. This feature enables a small face to be finished on one side of the work and a much larger face on the opposite side.

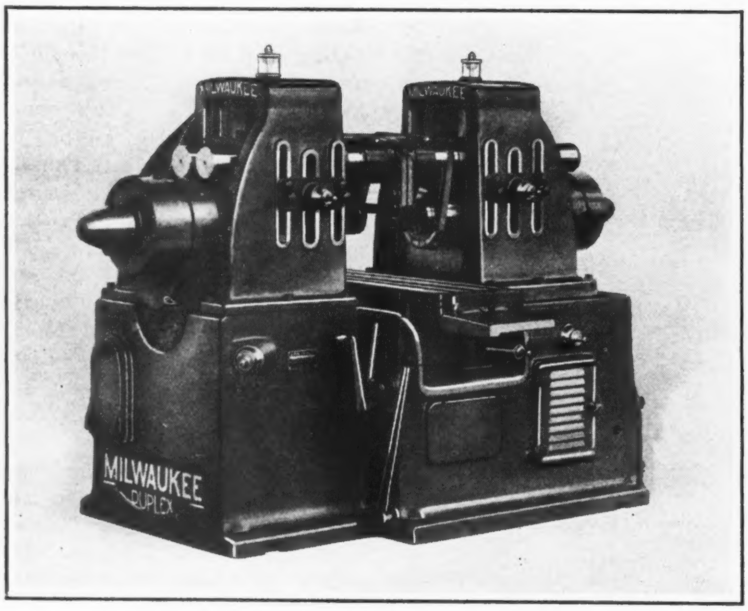


Fig. 1. Milwaukee Duplex Milling Machine Designed to Use Tungsten-carbide and Tantalum-carbide Cutters

Three ranges of feeds are also available—from 1/2 to 20 inches per minute, 1 to 40 inches per minute, and 2 1/2 to 100 inches per minute. There are eighteen individual feeds in each range. The power rapid traverse of the table is at the rate of 240 inches per minute. This duplex machine is made in two series—1200 and 1800. The table for the 1200 series is 12 inches wide and is provided with longitudinal power feeds of 18, 24, or 30 inches. The table for the 1800 series is 18 inches wide, and can be supplied with a power feed of either 24 or 30 inches.

Each spindle is mounted in a quill 7 inches in diameter, and is provided with an independent cross-adjustment of 7 inches. Movement of the quills is obtained through hand-cranks on the front of the uprights. A heavy brace ties each quill directly to the over-arms, so that the quill receives rigid support throughout the entire cross-adjustment. The spindles are driven through herringbone

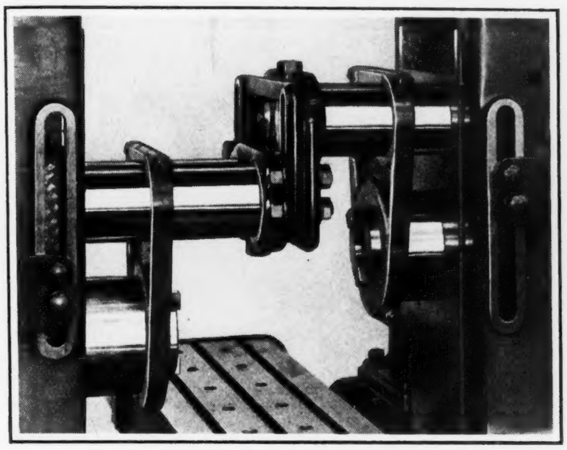
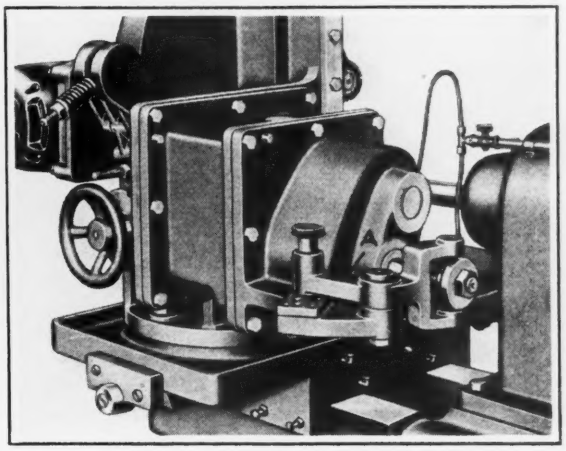


Fig. 2. Method of Tying the Over-arms of the Spindle Blocks together



Improvement on Peerless Chamfering Machine Eliminates Changing of Cams

gears, the larger gear being solidly attached to the spindle and the driving pinion being splined to its shaft.

The double over-arms of each spindle block can be tied together with the two spindles in the same plane or with one spindle higher than the other in the manner shown in Fig. 2. The spindle blocks are aligned by bearing surfaces for their full length on the uprights. Vertical adjustment of these blocks is effected by a hand-crank on the same side of the machine as the control levers.

The table dogs are mounted in a fully enclosed compartment which is accessible through a sliding door. Thus chips cannot interfere with the operation of these dogs. The machine is automatically lubricated throughout, and coolant is distributed to the work and cutters by a pump which operates only when the spindle is revolving. The machine is equipped with a multiple V-belt drive. It is intended to be driven by either a 7 1/2- or a 10-horsepower motor.

Improvement for Peerless Chamfering Machine

An improvement recently made in the Model 3 Peerless gear-tooth chamfering machine built by the City Machine & Tool Works, E. Third and June Sts., Dayton, Ohio, eliminates the necessity of installing different cams for each pitch of gear. It is only necessary to shift cam-lever *A* (see illustration) to the proper position. The desired results are obtained through four or five cams of different pitches mounted on a sliding shaft in the machine.

The worm and idler gear are unaffected by changes in pitch, the principal variable being a driving gear. This gear varies with the number of teeth in the work, as each gear to be chamfered must be driven by a gear having the same number of teeth or double the number. Both a single- and a double-thread quick-change worm are used, with the result that only about one-half the usual number of drive gears are necessary. On small lots, one of the gears to be chamfered may also be used as a driving gear.

An article concerning the complete machine appeared in February MACHINERY, page 469, and a description of the geared-head reduction motor with which the machine is equipped was published in April MACHINERY, page 640.

Van Norman Milling Machine with Motor Housed in Base

One of the new features of the No. 21 milling machine being introduced to the trade by the Van Norman Machine Tool Co., Springfield, Mass., is a motor drive that is completely housed in the base, where it is free from all chips and dirt. Ventilation of the motor is provided for not only by louvers in the sides of the column, but also by an opening that allows the air to circulate up through the column and out at the top. The motor is mounted on a sliding plate for convenience in aligning. There is adequate provision for motor lubrication. Power is transmitted to the machine through silent chains enclosed in cast-iron guards.

Another new feature of this milling machine is a power vertical feed to the knee. This feed is obtained by means of telescoping screws driven by bevel gears from the same mechanism that provides the longitudinal feed of the table and the cross feed of the saddle. The power vertical feed is controlled by two fixed stops and one adjustable stop on the column. One of the levers on the left-hand side of the knee is operated to start and stop the vertical feed, the other lever controlling the cross feed. Power longitudinal feed of the table is governed by a short lever on the front of the saddle. All feeds may also be started, stopped, and reversed by means of a single

lever on the right-hand side of the knee, provided the proper levers on the left-hand side of the knee or on the front of the saddle, as the case may be, are in engagement.

The crank-handle on the left-hand side of the knee enables the knee to be moved up and down by hand, while the crank-handle on the front of the knee provides a hand cross-feed for the saddle. Springs disengage these handles when they are not in use. A crank is applied in the usual manner to the ends of the feed-screw for hand adjustment of the table, there being a quick-return hand feed through a secondary gear. The table is stopped automatically through adjustable and fixed stops on the front of the table. All the feeds can be operated at the same time if desired.

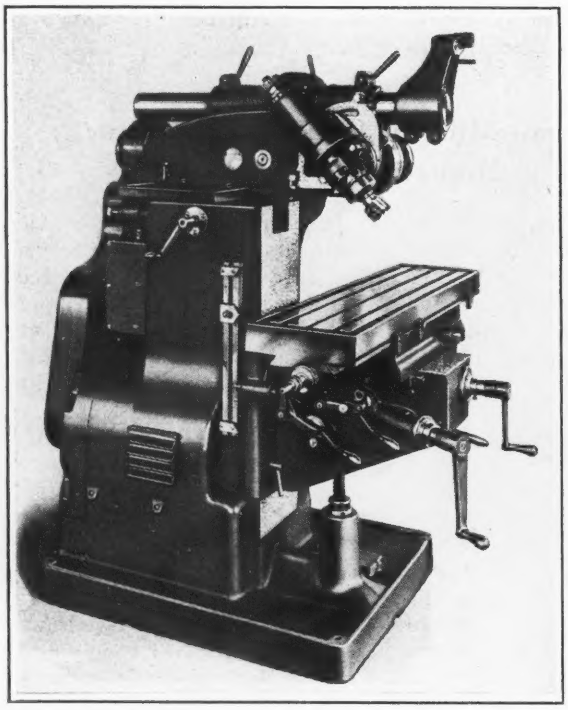
Sixteen feed changes for the vertical, cross, and longitudinal movements of the machine are obtained through a gear-box on the right-hand side of the column. From this gear-box power is transmitted through a telescoping shaft and universal joints to a gear train in a compartment on the right-hand side of the knee. These gears transmit the drive to the knee-elevating screw, cross-feed screw and table-feed screw. The train also comprises gears for reversing all feeds.

In other respects, this milling machine follows the general construction of the No. 20 machine. However, such improvements are incorporated as a longer ram, a heavier saddle, and a table of increased thickness, width, and length. Both the table and saddle have a taper gib with a screw adjustment. Ball bearings are provided at each end of the table-feed screw. As in previous designs, the spindle head can be used in any position from the horizontal to the vertical. Twelve spindle speeds are available through gears in the ram. Coolant is supplied to the cutter and work from a tank cast in the base by a reversing pump driven from the feed-gear box through a V-belt.

The important specifications are as follows: In and out movement of ram, 16 inches; automatic table movement, 27 1/2 inches; range of table feeds, from 1/2 to 10 15/16 inches per minute; length of power cross-feed, 10 3/4 inches; range of automatic cross-feed, from 1/2 to 10 15/16 inches per minute; length of power vertical feed, 19 1/4 inches; range of power vertical feed, from 5/16 to 6 7/8 inches per minute; range of spindle speeds, from 28 to 466 revolutions per minute; work-holding table surface, 45 by 11 3/8 inches; rating of motor, 3 horsepower; and weight of machine, about 4160 pounds.

Spot Welder for Small Shops

A spot welding machine designed expressly to suit the needs of small and medium-sized metal-working shops, tinsmith shops, etc., has been brought out by the American Electric Fusion Corporation, 2610-2620 Diversey Ave., Chicago, Ill. While primarily designed for welding thin-gage material, this equipment has sufficient capacity for welding sheets of No. 16 gage galvanized steel together or for welding such sheets to angle frames, etc., for the production of guards and similar parts.



Van Norman Miller with Motor in Base and Power Vertical, Cross, and Longitudinal Feeds

Spot Welding Machine Designed for Odd Jobs in Small and Medium-sized Shops

Joule Production Spot Welder

Simplicity of the electrical and mechanical units and a welded steel construction are features of the Joule production spot welder here illustrated, which is a recent development of the Federal Machine & Welder Co., Warren, Ohio. This machine can be operated either by foot or power, or both. With a minimum throat and maximum-size transformer, it will weld two pieces of 7/32-inch clean machine steel manually. When the machine is power-driven, at a slow speed, and has a minimum throat and a maximum-size transformer, it will weld two pieces of 5/32-inch clean machine steel. It is intended especially for welding material from No. 20 to No. 11 gage.

This machine is available with various throat depths from 10 to 24 inches. A multi-speed motor gives four welding speeds of 60, 90, 120, and 180 welds per minute. A constant-speed motor can also be provided that will give approximately 100 welds per minute.

The entire motor drive and control is mounted on a special back plate, which can be installed on any foot-operated machine without making changes. A feature of the air-cooled transformer is that the coils wound on the secondary are of pure "Electrolitic" round-edged copper, and are insulated between turns with fireproof material, 0.025 inch thick. There is sufficient overlap at the edges to prevent short circuits between turns. The secondary voltage is accurately governed by means of an eight-step regulator. A heavy trip switch, mounted on the back of the machine, is actuated mechanically. This switch may be conveniently adjusted to suit different conditions of service.

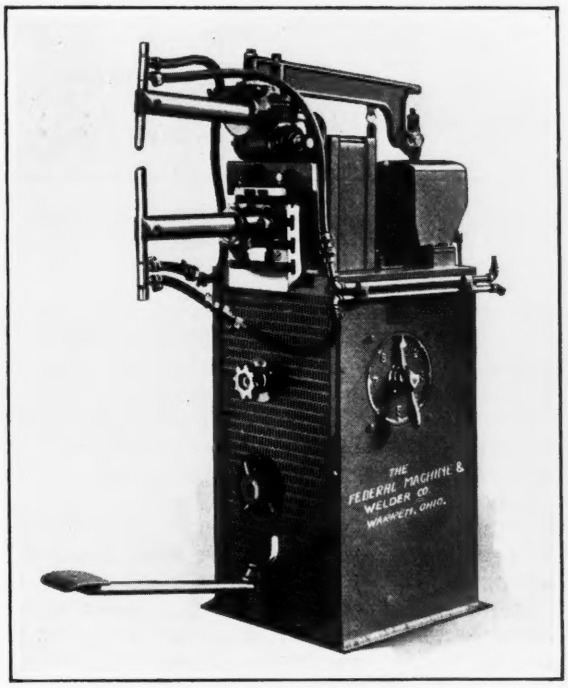
Both arms of the machine are made of 2-inch round hard-drawn copper. The upper arm is of the swinging fulcrum type. Both points are 7/8 inch in diameter water-cooled, and have replaceable tips.

Globe Combined Drilling and Tapping Machine

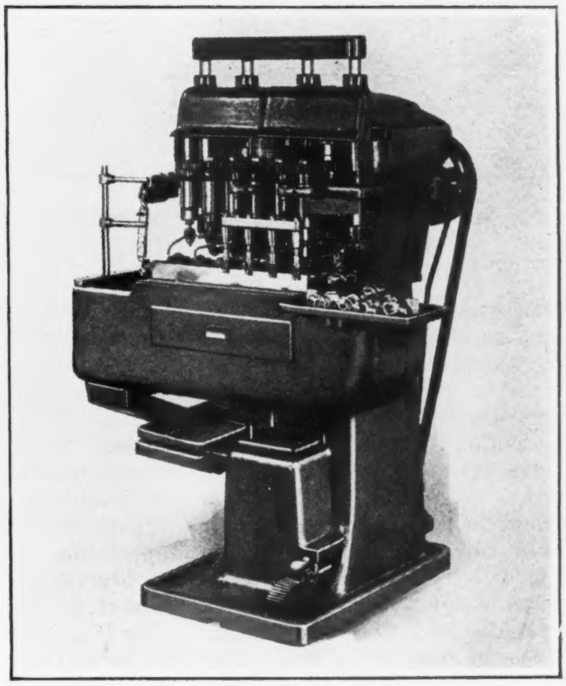
A combined drilling and tapping machine has been added to the products of the Globe Tapping Machine Co., 751 Central Ave., Bridgeport, Conn. The illustration shows this machine equipped with a standard conveyor table, but dial and push feed tables can also be supplied when desired.

The particular machine illustrated is built for drilling four small holes in a die-casting and for tapping two holes. Production is at the rate of thirty finished pieces per minute. The work fixtures are mounted on standard conveyor links, and index the parts 90 degrees when the conveyor itself is indexed. On the fixture shafts are mounted sprockets that turn against stationary pins on the table. With this arrangement, holes can be drilled and tapped at any angle, a spring plunger stopping the fixtures at the desired angle. Guide bushings provided for the drills also clamp the parts for drilling.

The spindles and index mechanism are driven by a 1 1/2-horsepower motor mounted on a tilting plate inside the base. Power is transmitted through a belt to a clutch at the top of the



Joule Production Spot Welder of Welded-steel Construction



Globe Drilling and Tapping Machine with Conveyor Table

machine at the rear, which is operated through a foot-treadle. One spindle slide carries drilling spindles and the other tapping spindles. By using a cam feed with a long lead and a quick rise for the drill slide, the maximum time for drilling is obtained.

This conveyor-feed table can also be employed on the regular tapping machine built by the concern or on machines used for drilling only. Pieces measuring up to 6 inches in width and about 14 inches in length can be handled by it.

V & O High-Speed Notching Press

A high-speed press primarily designed for notching electric motor laminations, but which is also applicable to other work, such as circular saws and bearing separators, is shown in Figs. 1 and 2. This machine is a recent development of the V & O Press Co., Hudson, N. Y. Attachments are provided for both internal or stator notching, as shown in Fig. 1, and external or rotor notching, as illustrated in Fig. 2. It is stated that tolerances of 0.002 inch or closer can be held on this work at operating speeds of from 450 to 600 strokes per minute.

To eliminate shock from engagement at high speeds, an automotive type of multiple-disk friction clutch is used in connection with a fully releasable brake. The slide is double the usual length.

For internal or stator notching, the indexing attachment consists of a circular base attached to the press bed. The outer circumference of this base is machined accurately and is fitted with a friction ring. The upper edge of this ring is flanged to provide for attaching the index ring. On top of the index ring is a plate to which the work to be notched is held by means of dowels or spring clips, or a combination of both. The assembly of the last three named members rotates freely about the outer circumference of the base. Motion is applied to the work by means of driving jaws actuated by a reciprocating lever. The driving jaws consist essentially of a split ring lined with woven asbestos.

For external or rotor notching, the driving jaws, friction ring, and index ring are placed on the under side of the table, as will be seen from Fig. 2. The work-holder on the upper side is driven by a spindle that extends through the table. Disks having outside diameters ranging from 3 1/2 to 18 inches can be handled with the external notching attachment. The minimum number of notches that can be cut is 12, and the maximum number that can be cut is 96.

The internal or stator attachment handles disks from 4 to 15 1/2 inches in diameter, and in this case also, the minimum number of notches is 12, but the maximum number is 132. Equipment can also be provided for notching stator and rotor blanks up to 72 inches in diameter.

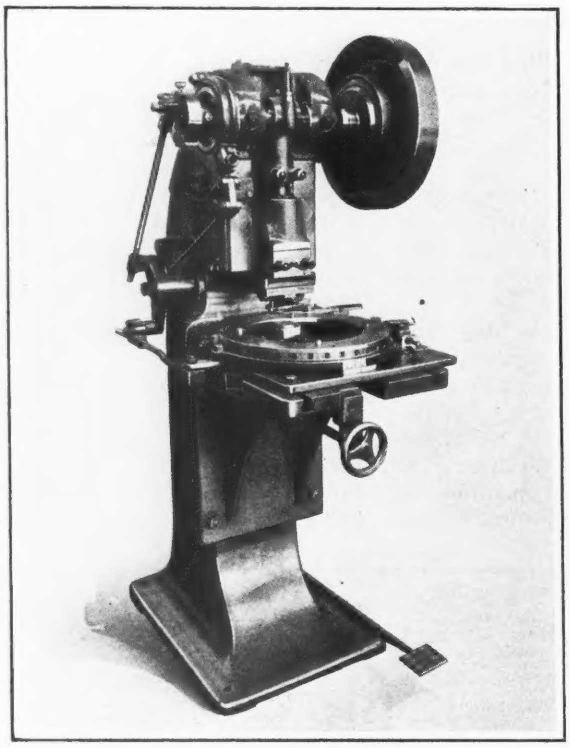


Fig. 1. V & O Notching Press Equipped for Internal or Stator Notching

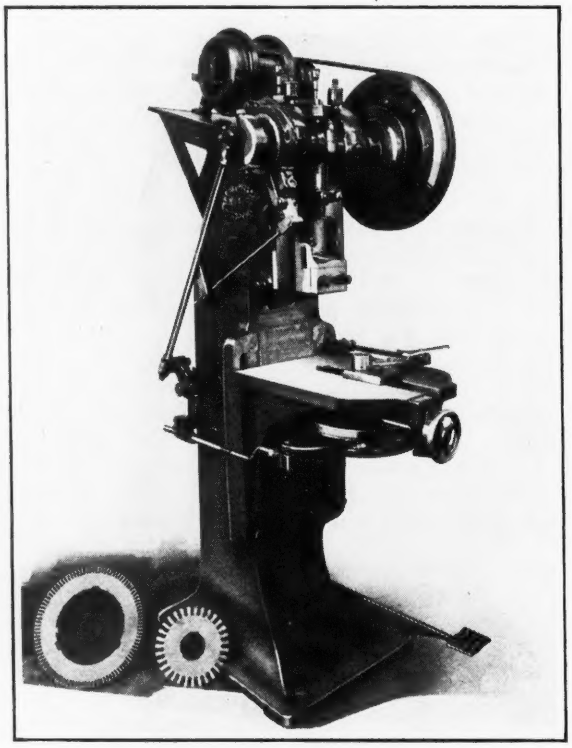


Fig. 2. High-speed Notching Press Fitted with Rotor Notching Attachment

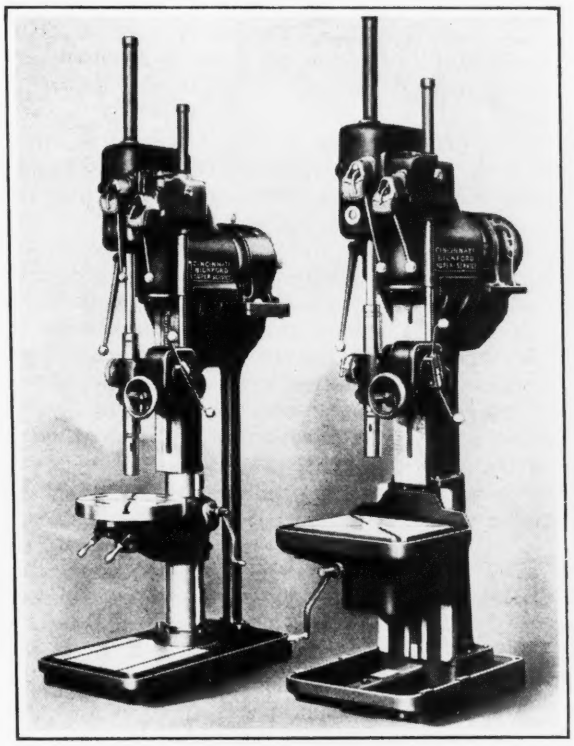
Cincinnati Bickford Upright Drilling Machines

Upright drilling machines built with either a round or a box column construction as illustrated have been placed on the market by the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio. These machines are known by the trade name of "Super Service," and are built in 21- and 24-inch sizes. They may be equipped for either general or single-purpose work.

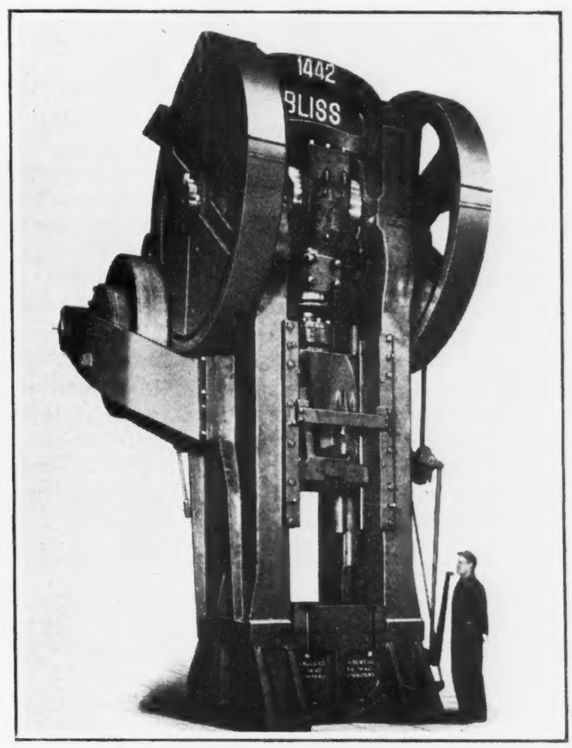
Twelve spindle speeds are available on the standard machines through selective sliding gears controlled by a single lever. These gears are made of heat-treated chrome-nickel steel, and are mounted on shafts having integral multiple keys. Ball and roller bearings are provided. Direct-reading plates indicate the speeds, as well as nine rates of feed. The feeds are also controlled by a single lever, conveniently located. Feed changes are obtained through selective sliding gears having broached integral keys.

The drop-worm type of feed engagement has been replaced by a constant-mesh worm running in oil. Engagement of the feed is obtained through either of the two pilot levers that control the advance and return of the spindle. A sidewise movement of either lever engages a positive feed clutch similar to that used on the "Super Service" radial drilling machine. A trip disengages the feed automatically at the required depth, while safety trips disengage it at the top and bottom limits of travel.

The driving motor is direct-connected to the machine. The driving clutches are completely assembled in a self-contained drum housing. They are mounted on large ball bearings that are automatically flooded with oil. In the round-column machine, the table arm, as well as the table, is clamped from the front. These drilling machines may be obtained as separate units or combined into gang drills.



Cincinnati Bickford Upright Drilling Machine of Round- and Box-column Designs



One of a Line of Bliss Single-crank Presses which has Recently been Redesigned

Bliss Large Single-Crank Presses

The illustration shows a large single-crank press of a line recently redesigned by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., with a view to obtaining improved performance in the manufacture of heavy stampings used in automotive construction. The press illustrated is of heavy construction, has a twin drive, is double-geared, and has a semi-automatic multiple-disk friction clutch.

The bed is designed for maximum stiffness, and its vertical webs are in line with the tie-rods. The tie-rod nuts are at the level of the feet, so as to eliminate any weakness due to nut pockets. The housings are larger and have broader seats at both ends. They are curved above the gibs to reinforce the front support. The back brackets are cast integral with the housing instead of being bolted to it in the usual way.

The crown has a heavy I-section arch and well braced tie-rod lugs. Depending upon the re-

quired stroke, the crankshaft may be of the full-eccentric, semi-eccentric, or cheeked-crank type. The connection is of a new patented design, with a motor-driven screw adjustment. Locking of the screw is accomplished without a split connection strap or body. All gearing is of steel.

The drive shaft at the back of the press has three bearing boxes —one on each housing and one on an outboard bracket. Each bearing box is equipped with Timken roller bearings. The clutch is operated through a control unit that unclutches and sets the brake at the top of the stroke.

"Hibbo" Bronze

A copper-aluminum alloy with a high steel content has been produced by the Central Brass & Aluminum Foundry Co., 1020 Woodrow St., Cincinnati, Ohio. The process followed in making this alloy, which is known as "Hibbo" bronze, enables the hardness to be controlled accurately to a predetermined degree. The hardness is uniform throughout the casting, and can be made from Brinell 100 to over 300, as desired. The tensile strength ranges from 50,000 to 90,000 pounds per square inch, according to the grade. High fatigue value, great ductility, unusual toughness, and acid and corrosion resistance are other properties claimed. The alloy is particularly suitable, because of its machineability, tensile strength, and resistance to wear, for service as bushings, gears, lift nuts, shifting forks, shoes, etc.

Pratt & Whitney Hydraulic Gear Grinder

Spur and helical gears up to 10 inches pitch diameter can be finished in a hydraulic gear grinder being placed on the market by the Pratt & Whitney Co., Hartford, Conn. One of the principal claims made for this machine is that gears can be ground at costs low enough to bring the advantages of ground gears within the reach of every gear user. The grinding wheel in this machine has both sides trued to a cone corresponding to the flat-sided basic rack that is the origin of the involute spur or helical gear-tooth system. Thus adjacent sides of two gear teeth can be ground at the same time. A full view of this machine is illustrated in Fig. 1.

A reciprocating horizontal ram, similar to that on a horizontal shaper, carries the grinding wheel back and forth through the teeth, as illustrated in Fig. 2. The stack of gears being ground is rolled past the reciprocating wheel under the guidance of a master gear and rack, so that the wheel always engages the work tooth for tooth as the master rack engages the master gear. The wheel makes as many passes per tooth as are necessary to produce the desired finish.

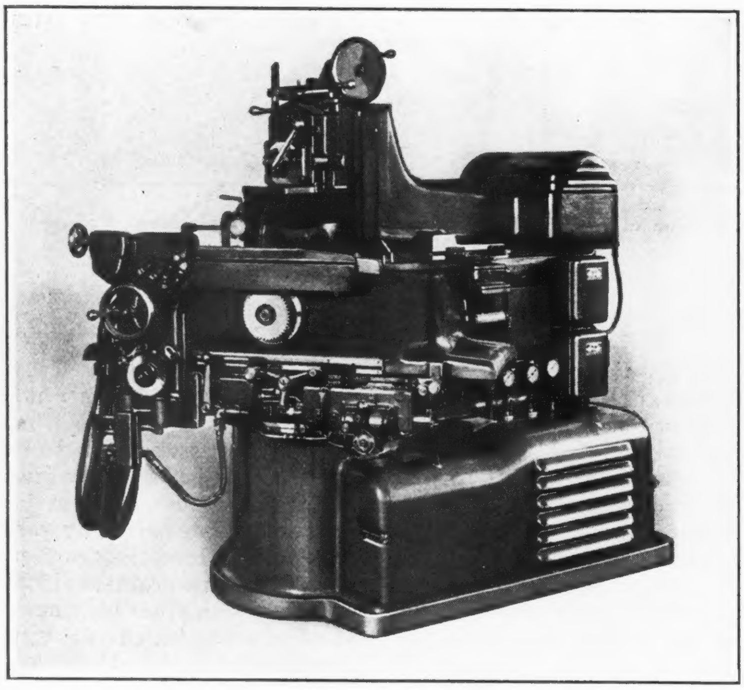


Fig. 1. Pratt & Whitney Hydraulic Gear Grinder for Spur and Helical Gears up to 10 Inches Pitch Diameter

Power is supplied to the machine by two motors. A three-horsepower motor running at 1800 revolutions per minute, which is contained in a housing on the ram, drives the wheel-spindle through a belt. Spindle speeds of 2215 and 2500 revolutions per minute are available, giving surface speeds up to 7000 feet per minute. Another three-horsepower motor, running at 1200 revolutions per minute, which is mounted under the cover on one side of the bed, as illustrated in Fig. 3, is direct-connected to two geared oil pumps and a centrifugal water pump. This motor supplies power for the entire hydraulic system and for supplying coolant to the wheel and work.

Ram speeds up to 50 feet per minute are obtainable, the speed being controlled by a relief valve. Reversal of the ram is accomplished without perceptible shock even at full speed. The ram stroke is adjustable for length and position by two dogs which operate the reversing valve, the maximum stroke being 6 1/2 inches.

The grinding wheel is dressed by three diamonds, held in three sliding bars, which are operated by a single lever. The two bars that hold the diamonds for dressing the sides of the wheel are adjustable independently to angles of from 13 to 30 degrees, by minutes.

The table is also driven hydraulically, and is reversed auto-

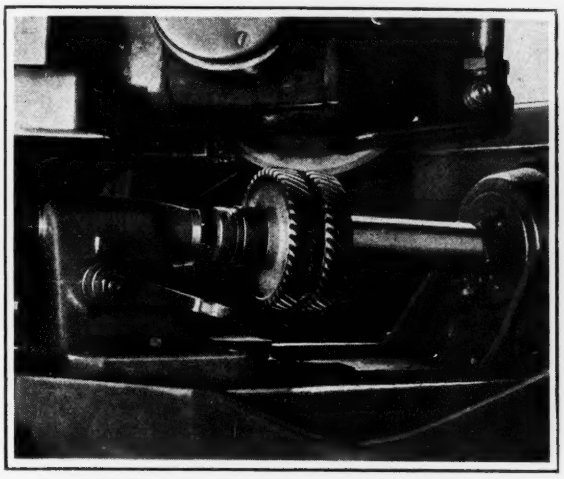


Fig. 2. For Helical Gears, the Work-slide is Set to the Helix Angle of the Gear to be Ground

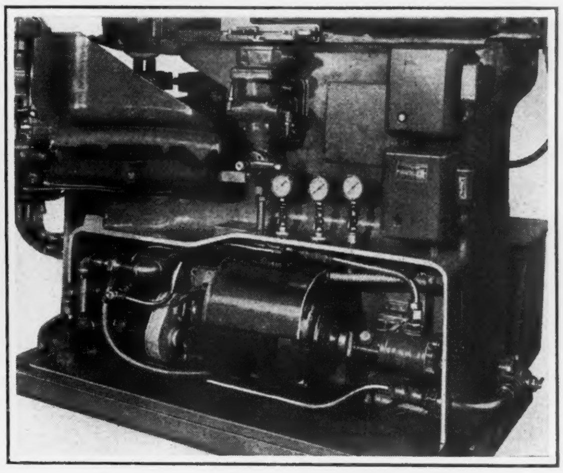


Fig. 3. One Motor Drives Two Oil Pumps for the Hydraulic Mechanisms and a Coolant Pump

matically. There are two speed ranges—a slow speed for grinding and a rapid speed for indexing. The speed is changed automatically from one range to the other by means of dogs which operate a valve. The slow speed can be varied for rough- or finish-grinding by moving a lever, and the rapid speed can be varied separately by a valve. When the work is finished, the table can be moved under power to the extreme right for ease in loading and unloading.

The gear blanks to be ground are held on arbors. The spindle is mounted in a large double-row ball bearing preloaded to 500 pounds. Special spindles can be used for unusual cases. For spur gears, the center line of the work is parallel with the ram movement and the work-slide moves perpendicular to the center line of the work. For helical gears, the work-slide is set to the helix angle of the gear to be ground, the ram movement remaining unchanged in direction. As before, the work-slide moves perpendicular to the center line of the work. Helical gears are thus generated by the same combination of straight-line and rotary movements as spur gears.

The master gear which controls the work is mounted on one end of the work-spindle. This master is a duplicate of the gear to be ground in number of teeth and diametral pitch and is thus of the same pitch diameter. It does not need to have the same pressure angle. One three-piece master rack is required for each diametral pitch.

Immediately above the master rack there is a slide on which two indexing racks are mounted. The motion of this slide indexes the master gear and the work. Indexing takes place at each end of the table movement while the master gear is out of mesh with the master rack and in mesh with either indexing rack, the work at the same time having rolled to one side out of contact with the wheel. After each full revolution of the work, the hydraulic drive to all parts is stopped automatically by a ratchet wheel mechanism which is also operated hydraulically.

Bardons & Oliver Automatic Cutting-Off Machine with Hydraulic Feed

Increased production and quicker set-up through the provision of a hydraulic feed, double slides, wider speed range, accessibility, and easy adjustment are the advantages claimed for an automatic cutting-off machine recently developed by Bardons & Oliver, Cleveland, Ohio. This machine is built in two sizes, of 3 and 4 1/2 inches capacity. Two hydraulic pumps are provided. The pump that feeds the slide is driven direct from the spindle, so that the feeds are obtained in thousandths of an inch per spindle revolution. The second pump operates the rapid traverse, and is driven direct from the motor, so that the rapid traverse remains constant. Relief valves are not required in the hydraulic feed circuit.

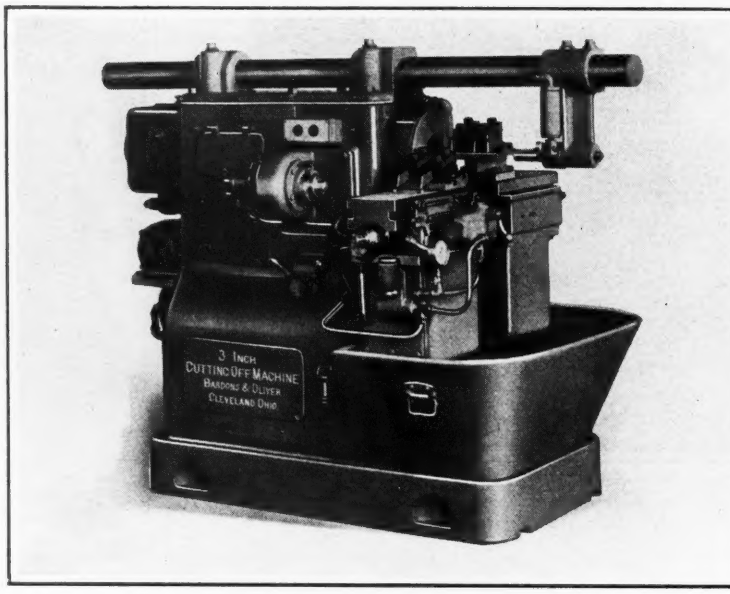
A single valve controls the feed, rapid traverse, and rapid return of the slides. Adjustable trip-dogs operate the hydraulic valve when the machine is running automatically. The valve may also be operated manually when the machine is being set up or when only a few pieces are to be cut off. Feeds from 0.001 to 0.040 inch per spindle revolution, in increments of ten-thousandths of an inch, are obtainable instantly by turning a graduated dial.

Two tool-slides, one at the front and one at the rear, when equipped with cutting blades that are used simultaneously, reduce the cutting time to half of that required on a single-slide machine. One slide may be used for chamfering while the other is being used for cutting off. Multiple tool-holders are furnished for each slide, and when lengths under 6 inches are being cut off, two or more pieces can often be cut at the same time.

The spindle speed-box gives four selective speed changes in

geometric progression. Pick-off gears provide a closer selection of speed if desirable. Spindle speeds of 1200 revolutions per minute can be used without damage or excessive noise. The feed dial, speed-change levers, and electrical controls are centralized, within easy reach of the operator.

By means of the patented roller bar-feed mechanism, the bar can be fed out 10 feet or more. The collet is of a hinged type, operated by air. False jaws to suit different diameters are quickly changed without removing the collet. The main drive motor is mounted in the column. There is a separate motor on a bracket at the rear for driving the roller bar feed and coolant pump.

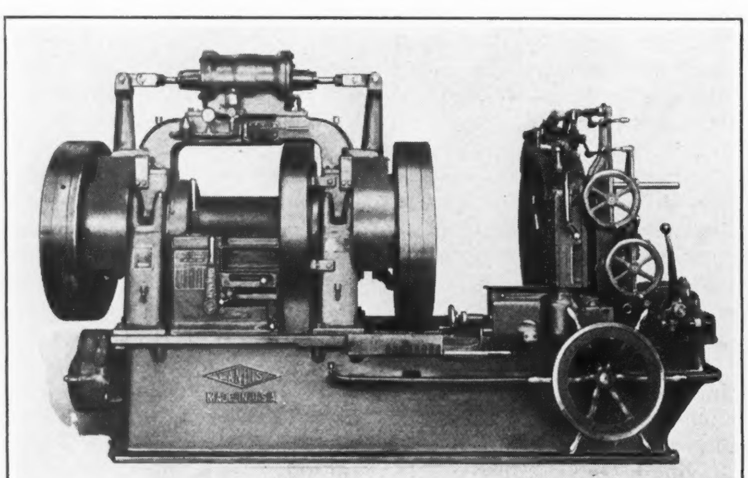


Bardons & Oliver Hydraulically Operated Automatic Cutting-off Machine

Landis Pipe Threading and Cutting Machine

Air-operated chucks are a feature of the 8 5/8-inch pipe threading and cutting machine here illustrated, which was recently built by the Landis Machine Co., Inc., Waynesboro, Pa. The chucking attachment is controlled by a four-way valve, which automatically returns to the neutral position when the operator removes his hand from the control lever. It is stated that the air consumption of this attachment is unusually low.

The chucks exert a powerful grip on the work with practically no effort on the part of the operator. There is no possibility of the grips loosening their hold on the pipe during the threading operation.



Landis Pipe Threading and Cutting Machine Equipped with Air Chucks

Pease Continuous Blueprinting Equipment

Blueprints, negatives, and blue-line or brown-line prints can be produced at any printing speed up to 12 feet per minute in the Peerless Model 25 continuous blueprinting equipment that is being introduced on the market by the C. F. Pease Co., 822 N. Franklin St. Chicago, Ill. This equipment comprises a blueprinting machine, a washing machine, and a potashing, washing, and drying machine. The blueprinting machine can be operated independently of the remainder of the equipment by the simple adjustment of a clutch. Also, it can be purchased separately and the washing, potashing, and drying equipment added at any future time. All units are made in two widths—42 and 54 inches—and can be supplied for operation on either direct or alternating current.

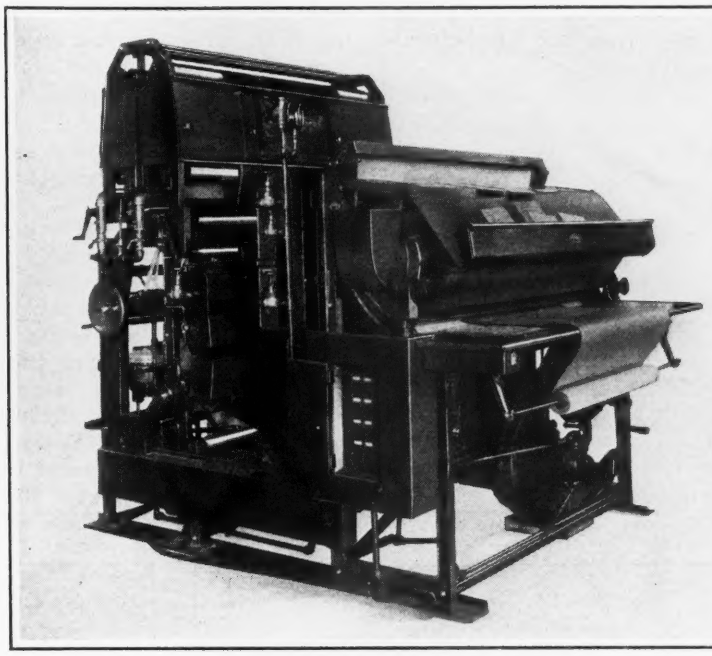
When the equipment is operated continuously, the tracings are laid face up on a continuous roll of paper feeding in at the front of the machine, the same as in all other Peerless machines. After exposure, the tracings are automatically returned to the tray at the front of the machine while the roll of printed paper is carried through the subsequent operations. When single prints are being made, both the tracing and the print are returned to the tray.

The machine is driven by a variable-speed 1/4-horsepower

motor. Underneath the feed table is a gear shift which provides two speeds (high and low) and a neutral position. A hand-operated dial, connected to a rheostat, gives accurate and instantaneous control of the printing speed.

When printing continuously, the printed paper passes into an atomizer water wash which directs sprays of water, under pressure, over the entire front and back surface of the paper. This wash removes all chemicals and equalizes any expansion or contraction of the paper. The prints then come in contact with a roll, which applies either potash or negative solution uniformly over the entire surface. After this, they are again washed by sprays, and are finally carried to the drying unit.

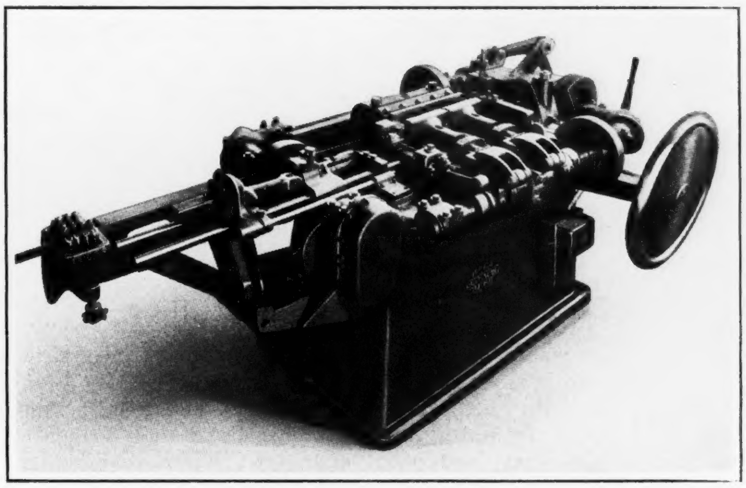
This unit is a new development, consisting of a twin-radiator air-type dryer. Either a gas or an electric heater can be furnished, the drying temperature being accurately controlled. A particular feature of the dryer is the provision of special side doors and sliding panels, which assist the operator in overcoming difficulties caused by humidity and still enable him to see the finished prints as they pass over the dryer and into the rolling-up device at the rear of the machine.



Pease Blueprinting Equipment with a Twin-radiator Air-type Dryer

U. S. Multi-Slide Automatic Cutting, Forming, Piercing, and Embossing Machine

A general-purpose, high-speed automatic machine known as the "Multi-Slide" has been brought out by the U. S. Tool Company, Inc., Ampere, N. J., for low-cost production in the manufacture of light- and medium-size metal stampings. A large variety of parts can be produced from brass, steel, phosphor-bronze, and other metals in a wide range of widths and thicknesses. Blanking, forming, piercing, embossing, and cutting-off operations are performed accurately on coiled stock at production rates up to 300 pieces per minute.



Multi-slide Machine which Cuts, Forms, Pierces, and Embosses Coiled Stock

From a reel, the stock passes between vertical straightening rolls to a reciprocating positive-feed mechanism which is operated by a crank having an adjustable throw. Beyond the feeding jaws, a cam-operated clamp holds the stock in position in the die during the reverse movement of the jaws and while the tools are in operation. The cutting die is a complete unit which is easily interchanged for different work. The cutting-die units have as many stations as are required to perform the operations.

After the stock has been advanced from the cutting die, forming tools, which are operated by cams, shape the part. The forming operations are completed in one location of the stock, as the forming tools can be set to operate in any direction to suit the particular part. The

stock is held positively in every position, resulting in accurate finished parts.

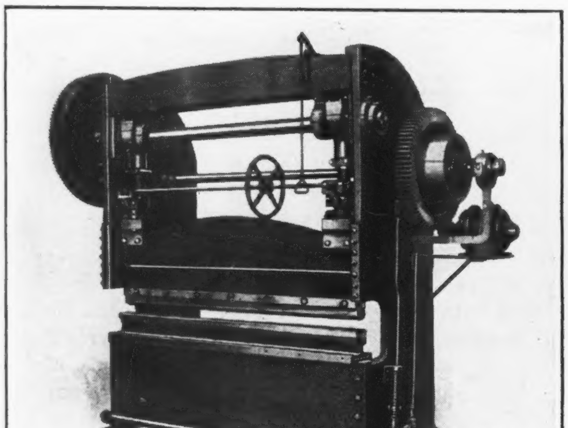
This machine is made in four sizes, including one bench type and three floor types.

Dreis & Krump Light Press Brake

A line of light-type press brakes built entirely of arc-welded steel has been added to the sheet-metal working machinery built by the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill. The housings of this machine are of one-piece construction, with a deep gap that allows work longer than the length of the die to be passed through the machine from left to right.

The ram is also of one-piece construction, with a loose clamping bar that enables tongued dies to be changed quickly. The bed is constructed of two plates, with a standard spacing of 1 1/2 inches between. This spacing makes it possible to use the press for multiple punching with an inexpensive attachment. The gear wheel is also made of welded steel.

The machine is operated by a friction clutch, and can be stopped at any point on the up or down stroke. Adjustment of the ram is provided for by means of a handwheel in the front center of the press. Motor adjustment of the ram can also be furnished if desired. The machine is arranged for motor drive, either through gearing or V-belts. It is built in four capacities, and in lengths of 3 to 8 feet.



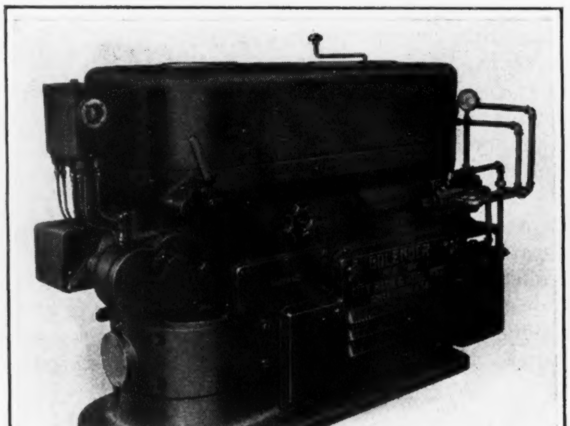
Dreis & Krump Light Press Brake Constructed Entirely of Arc-welded Steel

Bolender Hydraulic Gear-Burnishing Machine

A Bolender Model 2-H gear burnisher, which is operated by hydraulic pressure, is being introduced on the market by the City Machine & Tool Works, E. 3rd and June Sts., Dayton, Ohio. With the exception of the hydraulic operation, this machine follows the design of the air-operated Model 2 burnisher described in MACHINERY, May, 1930. The Model 2 machine will continue to be a regular product, the Model 2-H being intended for gear plants that require greater uniformity, in addition to the cushioning action of hydraulic pressure.

The new machine is completely automatic, so that all the operator is required to do is to load the work, move the control lever to turn on the hydraulic pressure, and press a single push-button. The gear is then revolved under hydraulic pressure a given number of turns in one direction, automatically reverses, and then turns an equal number of revolutions in the opposite direction, finally stopping automatically.

The number of revolutions that the gear is turned in each direction can be quickly varied from approximately 3 to 30. An open-faced dial enables a constant check to be kept on the hydraulic pressure. The machine regularly has a capacity for gears up to 14 inches outside diameter, but this capacity can be increased to 25 inches.

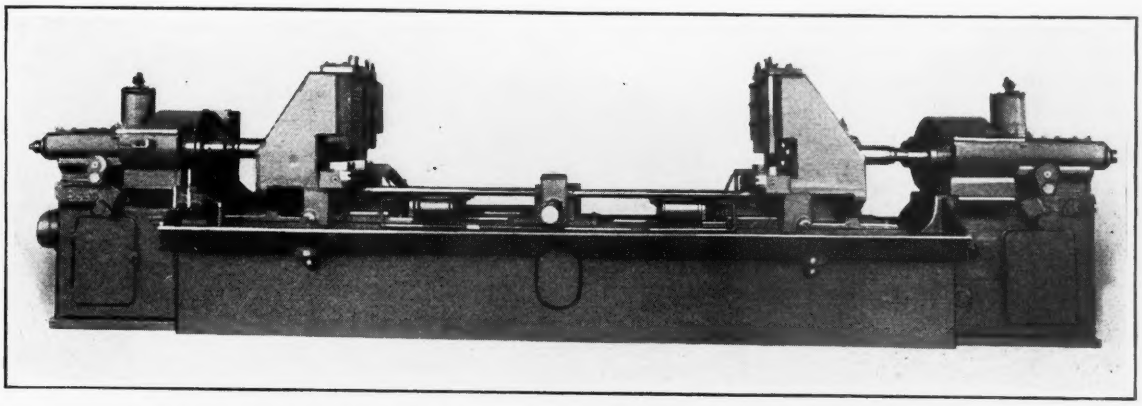


Bolender Gear-burnishing Machine in which the Work is Revolved Hydraulically

Baker Duplex Cam-Feed Machine

A cam-feed machine with a two-spindle head at each end has recently been built by Baker Bros., Inc., Toledo, Ohio, for facing, boring, threading, and tapping pipe. The illustration shows this machine arranged for cutting a thread 2 1/2 inches in diameter on cast-iron pipe of 9-foot lengths. It is also designed to handle 6-foot lengths and to cut threads 2 and 3 inches in diameter.

In the operation of this machine, the pipe is rolled on a carrier which, in turn, rolls it un-



Baker Duplex Machine for Boring, Facing, Threading, and Tapping Cast-iron Pipe

der the first station. Here it is raised by air devices into jaws that fit over a hexagonal section near each pipe end. When the machine is started, the cam provides a rapid advance of the tools to the work, one end of the pipe being turned on the outside and faced while the other end is bored and faced. The piece is then dropped into the carrier and moved to the next position, where it is again raised into jaws. Here, one end is threaded on the outside and the other end is tapped.

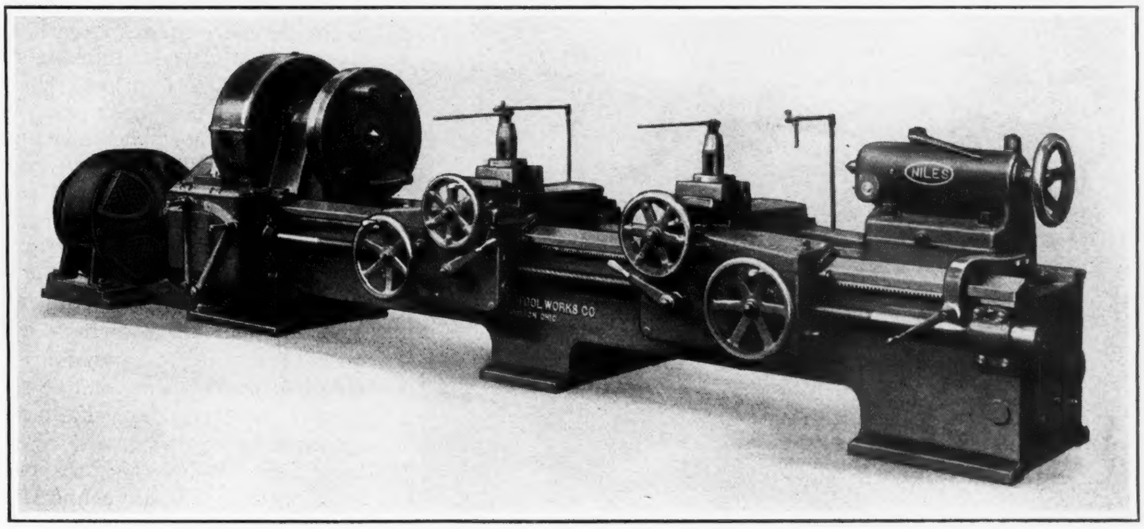
The pipe is finally lowered and automatically rolled off the machine at the rear. In the meantime, another piece of pipe has been loaded at the front, so that after the machine has once been started, a pipe is completely turned, bored, faced, threaded, and tapped at each cycle.

By means of the cam feed, a facing dwell is obtained, as well as a positive lead for the threading tools. Change-gears provide different speeds for tools of various diameters. The fixture carriages are adjustable to accommodate different pipe lengths. The tool carriages, as well as the elevating jaws, are air-actuated. Taps and dies of collapsible types are employed, so that reversal of the spindles is not necessary. The total weight of the machine as shown is about 23,000 pounds.

Niles End-Driven Lathe for Long Work

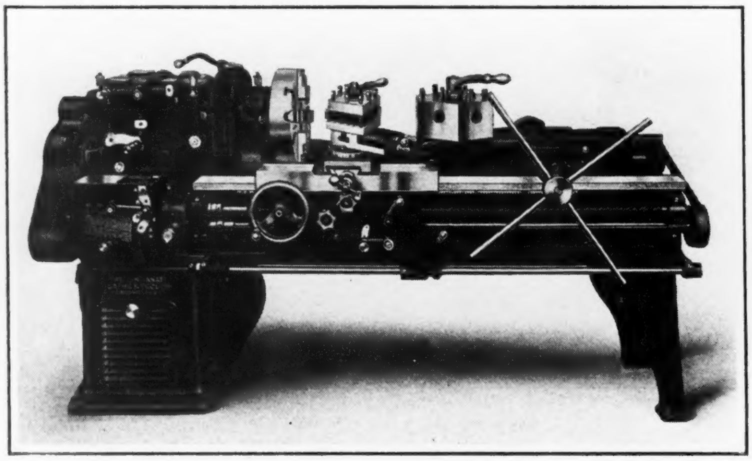
A high-production lathe of end-driven construction, as illustrated, has been brought out by the Niles Tool Works Co., Hamilton, Ohio. This machine is intended particularly for turning locomotive axles, piston-rods, crank-pins, brake-beam ends, and similar work, and is designed for precision work as well as rough turning.

The headstock is fully enclosed and is driven through a gear and pinion of the herringbone type. End thrust is taken by a series of bronze liners which are continuously lubricated. The carriages can be arranged to suit requirements. Wipers with felt pads are attached to the wing ends of the carriages for removing all chips and dirt from the bed ways. They also provide a continuous supply of lubricant.



Niles Lathe for Turning Locomotive Axles, Piston-rods, and Similar Parts

The aprons are of double-wall construction, enclosing all the operating mechanism and eliminating overhung shafts. All the gearing is of the Maag tooth form. A centralized oiling system has been applied to all moving parts, wherever possible.



Cincinnati Lathe with Hexagon Bed-turret and Square Tool-block

Greenfield "Tru-Lede" Taps

A line of "Tru-Lede" taps, which are ground after hardening, is being placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. The line includes hand, machine screw, and gun styles in all standard sizes and pitches. The taps are made from high-speed steel only. They are intended for production threading, and have been designed with a view to eliminating difficulties in screw thread assembly. The lead tolerance is given as 0.0005 inch per inch of thread.

Turret Attachments for Cincinnati Lathes

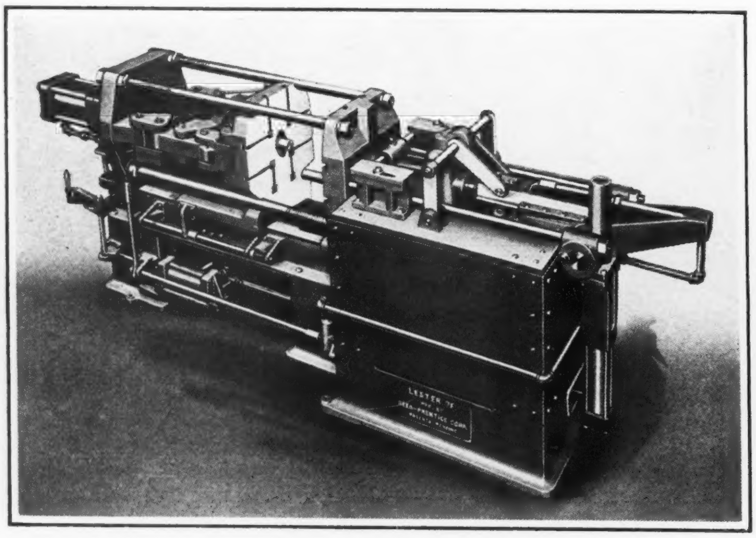
Hexagon bed-turrets are now manufactured by the Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati, Ohio, for the lathes ranging from 16 to 32 inches in size manufactured by this concern. The illustration shows a 20-inch by 10-foot motor-driven lathe equipped with one of these turrets and a square tool-block. The turrets index automatically, and an automatic independent feed-stop is furnished for each face.

Hand or power feed can be arranged for. Power feed is obtained through a pulley on the right-hand end of the feed-rod, which is connected to a second rod at the back of the bed. The power feed is disengaged automatically by a trip within a reasonable degree of accuracy. This trip is supplemented by a positive stop which enables parts to be finished to length within 0.001 inch. Indexing of the turret to any position can be accomplished without returning the slide to the extreme end of its stroke.

Another development of the concern is a simple angle-plate designed to be bolted to the face-plate of lathes in order to facilitate boring work concentrically.

Lester Hydraulic Die-Casting Machine

Hydraulic operation is one of the features of the die-casting machine here illustrated, which is built for the Lester Die & Machine Co., Cleveland, Ohio, by the Reed-Prentice Corporation, Worcester, Mass. This machine is a re-design of the model described in November, 1928, MACHINERY, page 231. It is built in four sizes or types, with die openings of 8, 11, 14, and 19 inches. The maximum die space ranges from 17 to 34 inches, and the minimum die space from 6 to 16 inches. Up to 250 "shots" per hour can be averaged by the smallest machine of the line, and 75 by the largest.

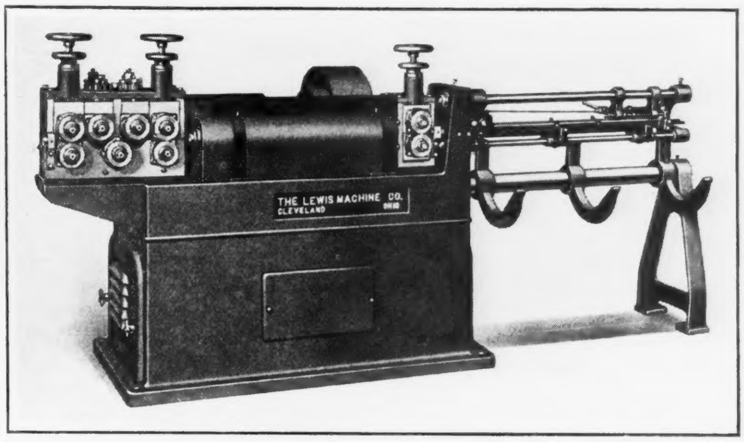


Lester Die-casting Machine which is Operated Hydraulically

In the operation of this machine, the hydraulically operated gooseneck is automatically submerged in the metal to allow it to fill to a predetermined level. The cylinder that brings the gooseneck up to position is mounted on the same end of the machine as the gooseneck, and is operated by a lever on the right-hand side. When the gooseneck is in position, the air connection is automatically brought into position, ready for the applica-

tion of air when the operator moves a second lever that controls an air valve.

An automatic hydraulic cylinder can be furnished for ejecting the casting from the dies. Automatic removal of the cores during the opening stroke of the machine can also be arranged for. Interlocking safety devices make it impossible to have the dies open when the air pressure is applied.



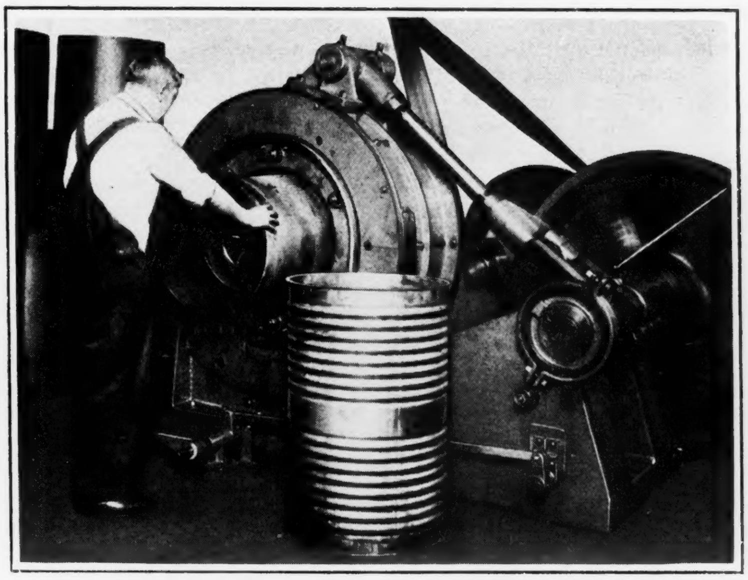
Lewis Automatic Wire Straightening and Cutting Machine with Quick-action Cut-off

Lewis Automatic Wire Straightening and Cutting Machine

The important features of an automatic wire straightening and cutting machine recently developed by the Lewis Machine Co., 1592-1600 E. 24th St., Cleveland, Ohio, include a quick-acting cut-off, a three-speed transmission, a seven-die straightener arbor with variable die spacing to permit handling a great variety of wire, an independent adjustment for the straightener rolls, the use of thirty Timken roller bearings, and a built-in motor drive.

The cut-off is operated by an eccentric on the end of the flywheel shaft. The eccentric is so arranged that the wire is cut the instant that the clutch is engaged. Therefore, the wire feeds through the machine during the remainder of the stroke or revolution of the flywheel. This reduces the cut-off time to approximately 1/8 revolution of the flywheel.

The three-speed transmission makes available a range of feeds suitable for all kinds of wire without the use of a variable-speed motor. Five straightening rolls are used in combination with two sets of feed rollers, all the rollers being mounted on Timken roller bearings. The two upper, or idler, straightener rolls have an independent adjustment, so that they can be set to straighten the wire as it comes from the reel before entering the rotary straightener arbor. This unit allows a fast feed with less offset in the arbor.



Bliss Machine which Flanges and Corrugates Drums Complete at the Rate of Five or Six a Minute

Bliss Semi-Automatic Drum Flanging and Corrugating Machine

Five or six drums can be flanged and corrugated per minute on both ends by the use of the machine here illustrated, which was recently built by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. This machine is of the expanding jaw type, having both inner and outer expanding members. After one end of the drum body has been inserted in the machine as shown, the drum is flanged, the first section bead is formed, the second section bead formed, and so on until one-half of the drum body is corrugated. The inner jaw members then collapse and the outer jaw members open to allow the operator to remove the drum. The other end of the drum is next inserted in the machine and the operations are repeated on this end.

This method of corrugating has the advantage that the wall thickness of the material in the drum body is not affected in any way. Another feature of the method is that the drums are resized at each end, thus facilitating double seaming.

Rivett Bench-Lathe Mounting and Driving Equipment

All rotating parts in the headstock of the bench lathe illustrated in Fig. 1 are fully enclosed to protect them from dirt and to guard the operator from injury. This lathe is a member of the Series 505 recently developed by the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass., which have a round-hole collet capacity ranging from 5/8 to 1 1/8 inches. Four plain-bearing headstocks are available, as well as a high-speed ball-bearing headstock of 7/8-inch collet capacity, which is particularly intended for use with tungsten-carbide cutting tools.

This lathe can be equipped with a speed-box motor drive, as illustrated, or with a horizontal safety-drive countershaft. Belt shifting is effected by means of a rod, through the knob seen at the left-hand side of the headstock base. Six speeds forward and, with a reversing switch, six speeds in reverse, are instantly obtainable. The headstock can be oiled through a small removable cover plate at the rear.

Access is provided at the rear to the headstock jack pedestal for adjusting the height of the lathe in order to maintain the desired tension of the endless driving belt. A jack pedestal is also supplied at the tailstock end of the bed. The rear section of the head is removable for adjusting the spindle bearings when necessary, and both rear and front sections can be removed when it is desired to apply a new endless belt.

Fig. 2 shows a lathe equipped with a motor drive, in which a three-step cone pulley is mounted directly on the motor shaft. This type of drive is especially useful in connection with the high-speed ball-bearing headstock. It comprises an alternating- or a direct-current motor of 1/2, 3/4, or 1 horsepower running at 1750 revolutions per minute, or a motor of slower speed down to 600 revolutions per minute. The motor is mounted on a swinging plate, suspended under the bench or oil-pan. The three-step cone pulley affords a range of speeds adequate for many bench lathe uses.

A coil spring of sufficient strength to overbalance the weight of the motor and plate holds the motor normally in its upper position, where there is no contact of the belt with the driving cone pulley. When the treadle is depressed, the motor is drawn down against the spring tension to bring the cone pulley into contact with the belt for driving the lathe. The rod that connects the motor plate to the foot-treadle is adjustable for obtaining the correct tension on the belt. With the ball-bearing headstock, spindle speeds up to 4600 revolutions per minute are available.

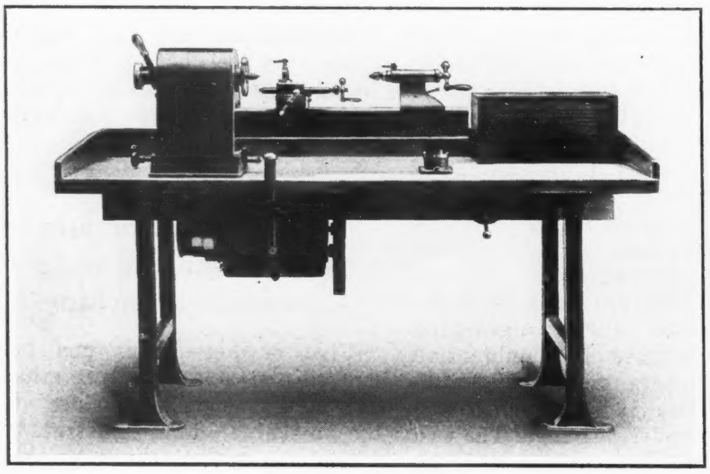


Fig. 1. Rivett Bench Lathe with Enclosed Headstock and Speed-box Motor Drive

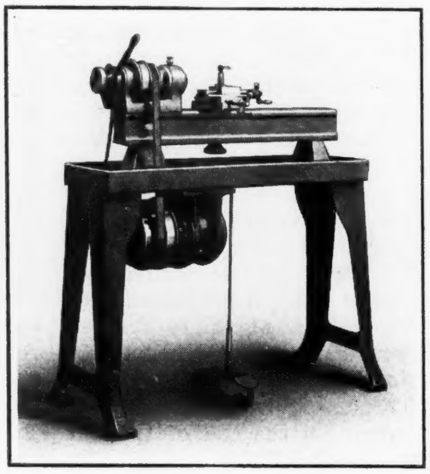


Fig. 2. High-speed Lathe with Cone Pulley Mounted on Motor Shaft

Brown & Sharpe Geared Pump

The Brown & Sharpe Mfg. Co., Providence, R. I., has brought out a pump of larger capacity than the Nos. 1, 2, and 3 geared types in the regular line. This new No. 4 pump has a capacity of 15 gallons per minute at 500 revolutions per minute. The corresponding increase in discharge for each increase of 100 revolutions per minute is 3 gallons per minute up to a maximum of 30 gallons per minute, which is obtained at 1000 revolutions per minute.

This pump is of the same design and construction as the other pumps made by the concern. It is particularly adapted for use as a coolant pump for machine tools and as a lubricant pump for large machinery.

Hydraulically Operated Crankshaft Chucks

Hydraulic chucks designed for use in facing the cheeks and contours, turning the pins, and rough-turning the line bearings of automobile crankshafts were

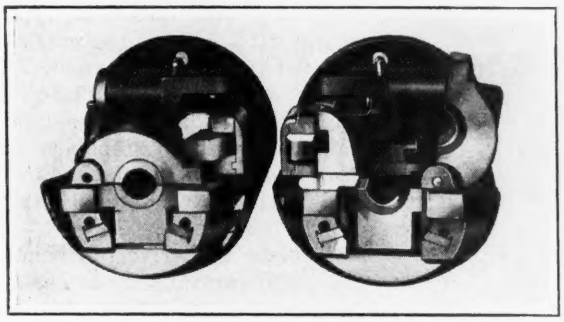


Fig. 1. Hydraulic Chucks Used on a Crankpin Turning Lathe

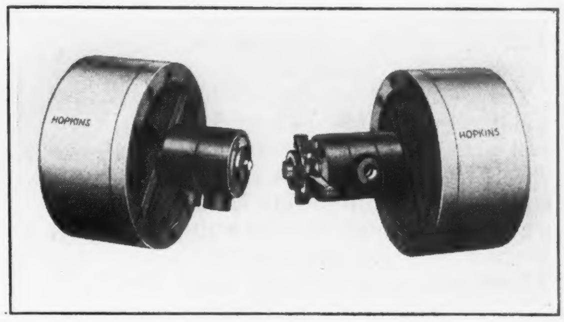


Fig. 2. Cylinders for the Hydraulic Chucks Shown in Fig. 1

recently made by the Tomkins-Johnson Co., Jackson, Mich., for application to a crankpin turning machine built by the Crankshaft Machine Co. of the same city.

The jaw-operating mechanism of these chucks (see Fig. 1) is the Hopkins patented bellcrank, and the rocker swivels are the same as those used in the Hopkins standard chucks made by the same company. The chucks are compact and of steel construction throughout. The body is a steel casting, while all parts that are subjected to strain are made of heat-treated alloy steel.

The hydraulic cylinders shown in Fig. 2 were provided for these chucks. A pump running in connection with the machine supplies the required hydraulic pressure. The action of the chucks and of the steadyrest cylinder is controlled by valves conveniently located at the front of the machine. A high rate of production in comparison with hand-operated chucks is the principal advantage claimed for this chuck.

H & G Large-Size Self-Opening Die-Head

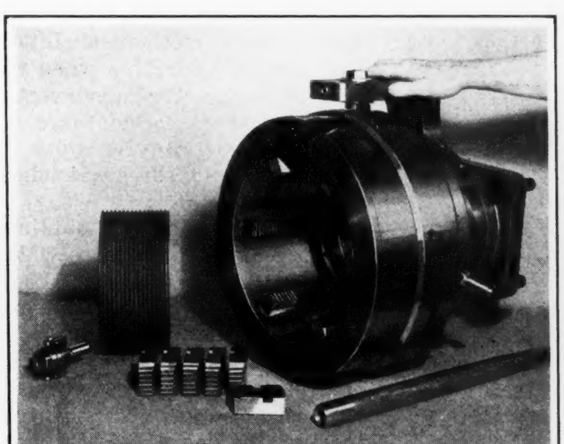
An H & G large-size, self-opening die-head designated as the 9-inch Style D "Heavy-Duty" die-head has just been brought out by the Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn. This die-head was designed to cut 6 1/4, 6 3/4, 8 1/8, and 8 7/8 inch threads, four per inch, of the American-National form.

This die-head weighs 325 pounds, and is 14 1/2 inches in diameter; however, the over-all length is only 10 inches, not including the shank. An idea of its size may be gained from the illustration, which shows, at the left, a 5/16-inch die-head used on Brown & Sharpe automatics.

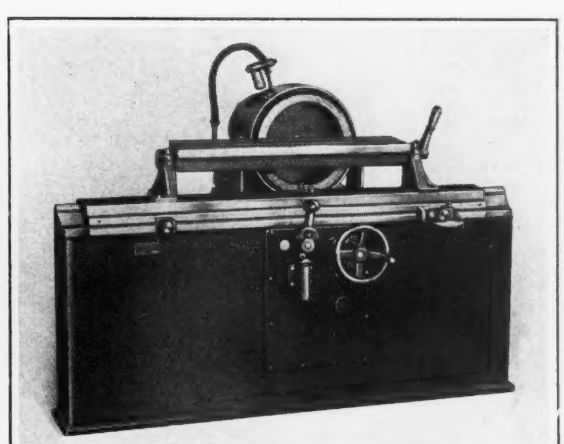
Six chasers make up a set. An adjustment is provided on the overhanging arm for accurate control of the thread length, while a micrometer adjustment on the faceplate gives accurate control of the pitch diameter. The head is closed by means of the long detachable handle shown in the foreground of the illustration. This die-head will be installed on a large Libby turret lathe for cutting threads on fire-hydrant barrels and standpipes.

Covel-Hanchett Knife Grinder

Knives and shear blades of many varieties can be sharpened in the machine here illustrated, which has been placed in the low-priced grinder field by the Covel-Hanchett Co., Big Rapids, Mich. This machine is equipped with a cabinet base, a ball-bearing wheel arbor, a Red-Anchor cyl-



Nine-inch Die-head Weighing 325 Pounds, Compared with a 5/16-inch Die-head



Covel-Hanchett Grinder of Full Automatic Design for Knives and Shear Blades

inder grinding wheel, and water attachments. It is designed for full automatic operation.

The standard equipment includes either a 12-, 14-, or 16-inch grinding wheel. Segmental wheels in all-steel chucks can be supplied when desired. The knife bar is installed as a solid unit integral with the carriage, and instead of feeding the knife bar, slides, supports, and work to the grinding wheel, the grinding wheel is fed to the work.

The transmission is the clutch-gear type of reversing unit employed in larger machines. It can be removed as a complete unit for replacements or repairs. The carriage is driven through a rack and hardened pinion by the transmission unit. Cross-feed of the grinding wheel to the work is available both by hand and automatically. The automatic feed is adjustable from 0.0005 to 0.002 inch; other ranges can be provided when desired.

Kane & Roach Cold-Roll Forming Machine

The cold-roll forming machine illustrated in Fig. 1 was recently designed by Kane & Roach, Inc., Syracuse, N. Y., for manufacturing a patented retainer strip used with gypsum board. This retainer strip is of the shape shown in Fig. 2. It is rolled complete with the scalloped edges in one pass through the machine at the rate of 100 feet per minute. Close limits for straightness in all directions are specified. The rolls are so made that strips without scalloped edges can be produced if desired. The strip stock is 3 11/32 inches wide by 0.020 inch thick.

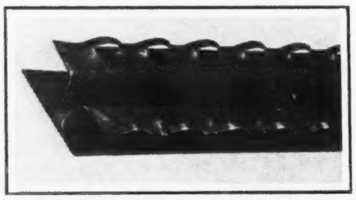


Fig. 2. Steel Strip Formed in Machine Shown in Fig. 1

The main frame of the machine is long enough to take eleven roller stands, but only nine are required for this particular job. The rolls are 4 1/8 inches in diameter. Their outer bearings are of a quick-removable type. Shearing and forming of the scalloped edges is accomplished simultaneously by the ninth set of rolls. These rolls have shearing edges that may be reground as they become worn.

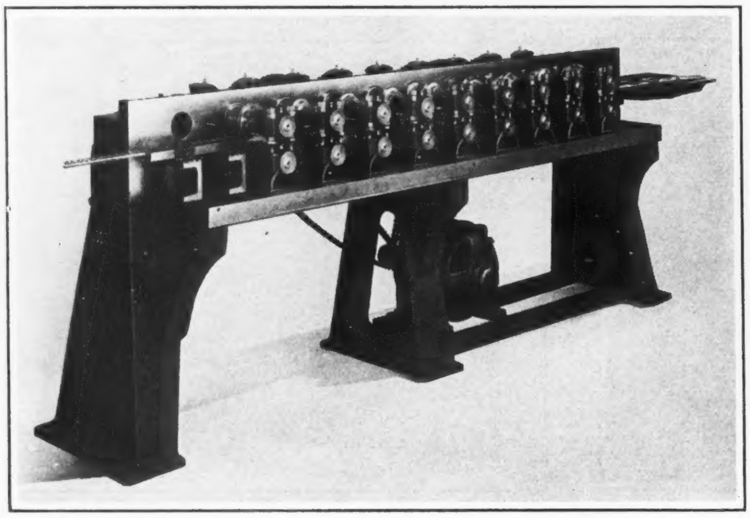


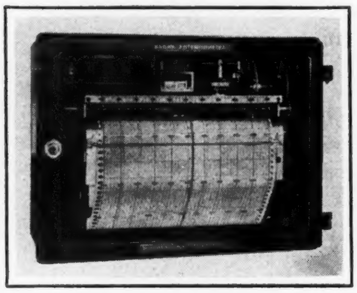
Fig. 1. Kane & Roach Cold-roll Forming Machine

Brown Potentiometer Pyrometer

The potentiometer pyrometer here illustrated is made by the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa., in indicating, recording, multiple-recording, and controlling types. About fifty-five new features are claimed for this instrument. The charts and scales are 12 inches wide and conform to the latest calibration values established for iron-constantan, chromel-alumel and platinum-rhodium thermocouples.

In order to derive full benefit from the carefully made charts, a correction means is provided for the expansion and contraction of the chart paper that takes place with changes in humidity. The correction is made by a humidity compensator, which automatically makes the pen register properly with the markings of the chart.

The dustproof case is suitable for wall, front-of-board, flush-type panel, or table mountings.



Brown Potentiometer Pyrometer with Many New Features

There are no openings in the case through which the chart must extend. The galvanometer is completely enclosed in an inside compartment having a glass window. Thus it is fully protected from mechanical injury and from air currents when the door is open. The galvanometer pointer and suspensions are relieved of practically all work by the introduction of a secondary pointer system.

Automatic control is obtained through mercury switches which can handle currents up to 50 amperes at 220 volts or 60 amperes at 110 volts. These mercury switches are sealed in glass. The control temperature is easily set by means of a knob that projects through the door. Stainless steel is used extensively in the potentiometer because of its non-corrodible properties.

High-Speed Ball-Bearing Snagging Grinder

When the No. 50 high-speed snagging grinder built by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio, was placed on the market (see May, 1930, MACHINERY, page 739), it was available with either 24- or 30-inch wheels. This grinder may now also be obtained with 20-inch wheels. Either a 7 1/2-, 10-, or 15-horsepower motor is provided, depending upon the wheel size. This machine is equipped with 3/8-inch fabricated steel boiler-plate guards having doors of the overlapping type. Power is transmitted to the grinding spindle through four Dayton "Cog-Belts."

Greenerd Arbor Press

An arbor press primarily designed for the electrical department of shops has been added to the Greenerd line manufactured by the Edwin E. Bartlett Co., Nashua, N. H. This press is intended especially for motor and armature work. When bearings are to be removed, a 3/8-inch pin is inserted in the bottom of the rack and the special push and pull plate shown in Fig. 2 is used. This plate is clamped around the motor shaft, after which the armature may be inserted in the 6-inch opening of the press and the bearing removed with ease. The pin is readily removed from the rack at the end of the operation.

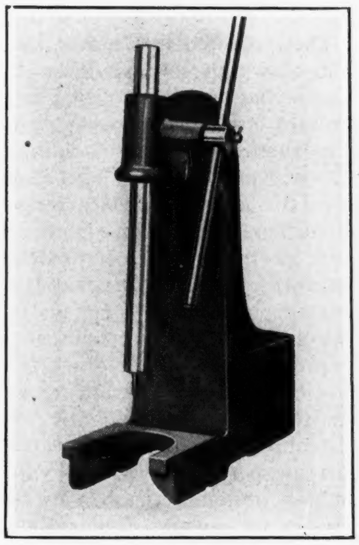


Fig. 1. Greenerd Arbor Press Designed for Electrical Work

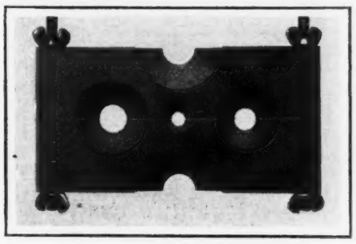
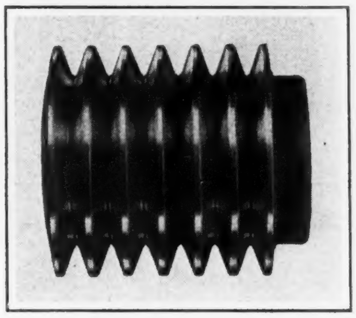


Fig. 2. Push and Pull Plate Used with the Arbor Press

"Wedgbelt" Pulleys

Pulleys with pressed-steel grooves have been developed by the American Pulley Co., 4200 Wissahickon Ave., Nicetown, Philadelphia, Pa., for multiple V-belt drives. These pulleys are known by the trade name of "Wedgbelt." The stamped sections that form the grooves are assembled about a cast hub that may be bored and provided with a keyway to suit requirements.



"Wedgbelt" Pulley with Pressed-steel Grooves

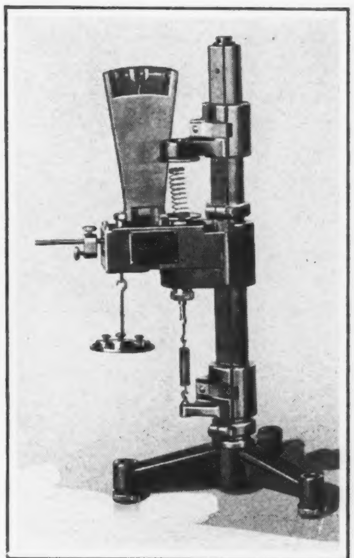
These pulleys are particularly recommended for service as driving or motor pulleys. One of the principal advantages of this construction is that the smooth surfaces of the bright steel groove stampings do not have any abrasive action on the belts. The pulleys have a natural balance, and the grooves are accurate as to angle and dimension. They are made in various sizes.

Driven pulleys, larger than the range of steel sizes, are obtainable in cast iron, these pulleys being made for the concern by another manufacturer.

Elasticometer Spring Testing Machine

Light springs such as are used in typewriters and adding machines can be tested for compression and extension in a Type RS Elasticometer, which has been added to the line of the Coats Machine Tool Co., Inc., 110-112 W. 40th St., New York City. This instrument works on knife-edges in the same manner as the larger instruments previously described in MACHINERY.

The maximum load capacity is only 5 pounds, and the scale consists of a single lever having a ratio of 1 to 1. The weight carrier is suspended from the outer end of this beam or lever. The inner end supports a bar guided in steel balls which carries a compression plate or platform above and a tension hook below. A pointer fastened directly to the beam completes the weighing scale. The scale is enclosed in a housing that is adjustable on the column. Both tension and compression tests are made by means of slides. Adjustable stops limit the travel of the slides for quantity inspection.

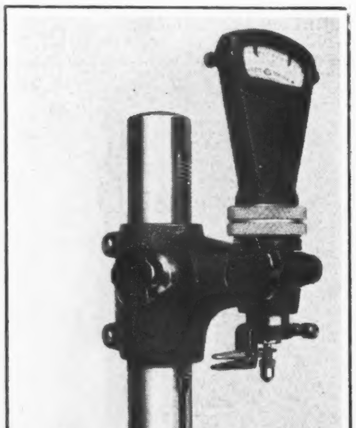


Elasticometer Testing Machine for Light Springs

Societe Genevoise Micro-Indicator Stand

A stand designed by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, for use with the Micro-indicator made by this concern is being placed on the American market by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The illustration shows this stand provided with the Micro-indicator, which was described in February, 1930, MACHINERY, page 497. The oval-shaped base of the stand is approximately 10 inches in length by 7 1/2 inches in width at the widest point, and rests on three rubber feet.

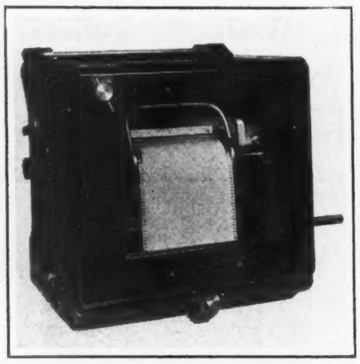
The table is hardened and lapped optically flat. It is 1 5/8 inches in diameter and has crossed grooves that make it easy to wring a standard flat-surfaced gage on the anvil in setting the instrument to zero before beginning readings. The column of the stand is fitted with a rack for quick adjustment of the arm through the rotation of a pinion in the arm. A clamp at the rear of the column locks the arm securely. The arm can be adjusted through a range of 6 inches, and since the axis of the indicator is 3 inches from the column, cylindric l parts up to 6 inches in diameter can be accommodated. The stand weighs 32 pounds.



Micro-indicator with Stand that Facilitates Inspection of Parts

Tapalog Recording Pyrometers

A series of improved Tapalog recording pyrometers is being placed on the market by Wilson-Maeulen Co., Inc., 382 Concord Ave., New York City, which are designed for making single and multiple records. These improved instruments are operated entirely by an industrial-type synchronous electric-clock motor which runs on alternating current taken from the lighting circuit or plant power supply. All models have an automatic electric cold-junction compensation. The instruments are made for any number of records up to six, and for various temperature scales up to 3000 degrees F. and equivalent Centigrade scales. The chart is 6 inches wide for each record.

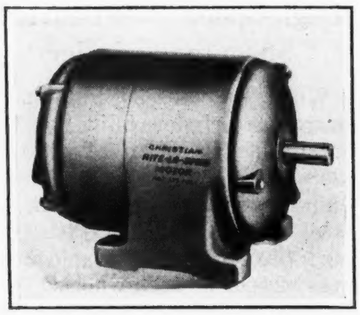


Recording Pyrometer Operated by Electric-clock Motor

Recording pyrometers employing thermo-couples and thermometers employing electric resistance bulbs are available in the new series.

"Rite-Lo-Speed" Motor

Helical alloy steel gears and a standard footless stator and rotor are embodied in the "Rite-Lo-Speed" motor here illustrated. This power transmission equipment has been designed by the J. D. Christian-Engineers, 512 Brannan St., San Francisco, Calif., in cooperation with engineers of the U. S. Electrical Mfg. Co. of Los Angeles. The gear end of the assembly is not a planetary system, there being only two gears and two pinions.



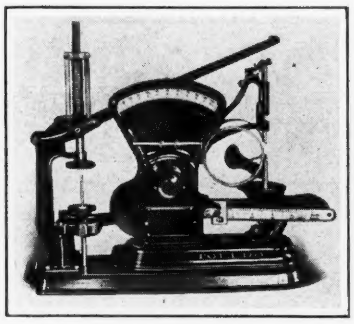
"Rite-Lo-Speed" Motor in which are Embodied Helical Gears

This motor is made at present in sizes from 1 to 30 horsepower, and there is a junior model which is made in sizes from 1/4 to 1 horsepower. The motor is made in four series: Series A, which is standard, has a single power take-off; Series B, which has a gear housing at each end, has two power take-offs at the same speed; Series C has two power take-offs at different speeds; and Series D has one power take-off at a reduced speed.

Piston-Ring and Valve-Spring "Auto-Gage"

The equipment here illustrated, which is known as the "Auto-Gage," has just been brought out by the Toledo Precision Devices, Inc., a subsidiary of the Toledo Scale Co., Toledo, Ohio, for comparing the strength of automotive piston-rings and for gaging the compression strength of valve springs. It is pointed out that uniform piston-ring pressure is of importance in keeping cylinder wear down to a minimum and in preventing excessive piston-ring blowing and oil-pumping. It is also mentioned that proper strength of valve springs prolongs the life of the valve cams, rollers, rocker arms, and valve seats, and maintains a better power balance.

This "Auto-Gage" is adjust-



"Auto-Gage" for Piston-rings and Valve Springs

able to any size of piston-ring. When the ring is in place and the lever compressed, the resistance of the ring is read directly from the scale by using the bottom black figures. To gage a valve spring, the spring is slipped over the removable spindle after the proper adjustments have been made, and the long handle is brought down against a stop. The compression strength is then read directly from the red or upper line of figures on the scale.

Kritzer Floating Motor Drive—Correction

In the description published in May MACHINERY, page 707, concerning the floating motor drive recently brought out by the Kritzer Co., 515 W. 35th St., Chicago, Ill., it was stated that the drive is regularly made in sizes suitable for motors ranging from 1/2 to 3 horsepower. This was an error, as the drive is regularly made for motors from 1/2 to 25 horsepower. It can also be supplied for application to larger motors.

Production Estimator

A calculator designed for use in determining the production of drilling, turning, forming, and cutting-off operations performed in turret lathes, automatic screw machines, and chucking machines has just been placed on the market by C. P. Kramer, 4554 W. Congress St., Chicago, Ill. This calculator, as shown in the accompanying illustration, is of pocket size and consists of two circular brass dials on which are etched figures and dividing lines. One-half the circumference of the large dial carries a scale of spindle speeds ranging from 35 to 3500 revolutions per minute. The other half carries a scale of elapsed time ranging from 2 seconds to 3.5 minutes.

The small dial, which turns on the large one, carries on the upper half of its circumference a scale of feeds in thousandths of an inch per revolution, and on its lower half, a scale of lengths or depths of cut in inches.

If a selected feed is set to the desired spindle speed, the cutting

Estimator for Determining the Production of Machines

time in minutes or seconds appears opposite the division corresponding to the length or depth of cut. After this figure has been determined, the production per hour can be read from scales on the face of the large dial through oblong windows in the small dial.

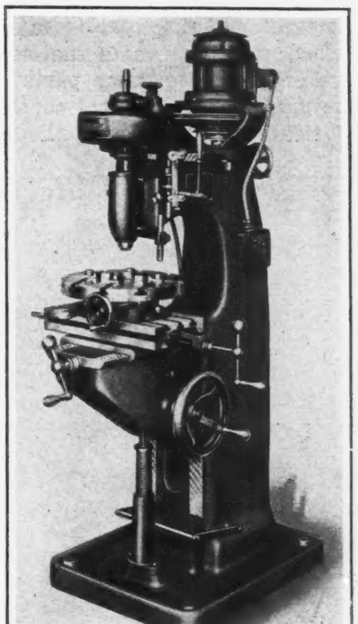
Conversely, the feed per revolution for a given length or depth of cut and a given spindle speed can readily be obtained. The effect upon elapsed time of an increase of, say, 0.0005 inch in feed per spindle revolution can also be determined.

Reed-Prentice Router and Vertical Milling Machine

A No. 2V router and vertical milling machine has been placed on the market by the Reed-Prentice Corporation, Worcester, Mass., for cutting brass, steel, and cast iron. This machine is a new design of the No. 2 size previously built by the company. One of its features is the vertical ball-bearing motor drive. The motor is of one-horsepower rating and runs at 900, 1200, or 1800 revolutions per minute, giving spindle speeds of 500 to 3000, 666 to 4000, and 1000 to 6000 revolutions per minute. Higher spindle speeds up to 12,000 revolutions per minute can be furnished. Ten spindle speeds are available in each series. The motor transmits power through endless molded V-belts. It is adjustable for obtaining the proper belt tension.

The spindle-pulley brake and lock permit the spindle to be stopped quickly for changing collets and cutters. The sliding head is operated either by a clutch handle or a foot-treadle. There is a micrometer depth stop, graduated in thousandths of an inch, with a vertical scale graduated to 2 inches and subdivided in tenths of an inch. The spindle sleeve will take either old or new style collets. The spindle is mounted in ball bearings, while an auxiliary bracket provides a double ball-bearing support to take the belt pull.

Heat-treated aluminum-alloy pulleys of four-step design are



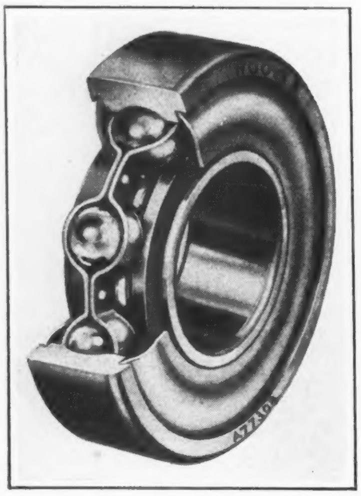
Reed-Prentice Redesigned Router and Milling Machine

used to obtain lightness in combination with strength and to reduce inertia in stopping. Large micrometer dials are supplied for all feed-screws. A profile device is provided as part of the regular equipment.

Important specifications are as follows: Longitudinal feed, 14 inches; cross feed, 11 inches; vertical feed of knee, 15 inches; travel of head with and without micrometer depth stop, 2 and 3 inches, respectively; maximum distance between spindle and frame, 15 inches; and net weight, 1650 pounds.

Hoover Duoseal Ball Bearing

A double-seal ball bearing just placed on the market by the Hoover Steel Ball Co., Ann Arbor, Mich., is shown in the accompanying illustration. This Duoseal bearing consists of a standard annular bearing with stamped metal plates on each side of the raceway. The plates are fitted tight to the outer ring and remain stationary with it. The inner edge of each plate fits a groove in the inner ring in a way that allows it to turn freely with the shaft. At the same time an effective seal is maintained, which prevents the leakage of grease to other parts of the machine and insures correct lubrication by retaining the oil or grease in the raceways. The bearing is available in standard S.A.E. sizes.

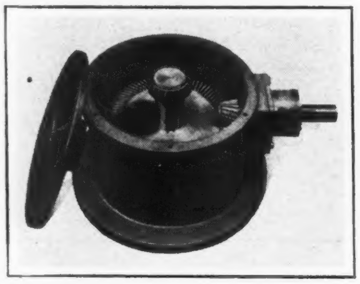


Hoover Ball Bearing with Double Seal

James Vertical Spiral-Bevel Gear Speed Reducer

The vertical spiral-bevel gear speed reducer here illustrated is being placed on the market by the D. O. James Mfg. Co., 1114 W. Monroe St., Chicago, Ill. This reducer is made in sizes of from 1/2 to 100 horsepower. When large ratios of reduction are required, it is made integral with a planetary reduction unit, so that all ratios from 8 to 1 up to 1600 to 1 are available.

The gears are made of chrome-nickel steel, and are of the spiral-bevel type to provide noiseless operation. Roller bearings are supplied for both the driving and driven shafts. The housing is designed to keep dust and dirt from filtering into the unit and to prevent leakage of oil.

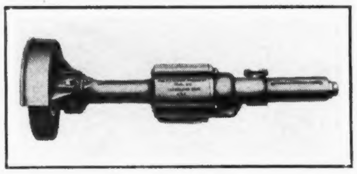


James Speed Reducer with Spiral-bevel Gears

"Cleco" Portable Air Grinder

A portable rotary-type grinder, recently added to the line of air-operated tools made by the Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, Ohio, is shown in the accompanying illustration. This grinder is made in several sizes and styles for general service in automobile plants, locomotive and car shops, foundries, etc. Two styles of handles provide for inside or outside throttle-lever control.

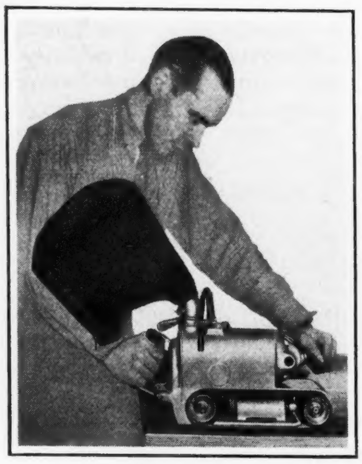
This grinder has a single rotor which is concentric with the arbor. Four longitudinal slots in the rotor accommodate blades that are forced outward to the wall of a stationary cylinder set eccentrically in relation to the rotor axis. As one blade is always exposed to the air current, a constant rotation is obtained. Oil is delivered automatically to the rotor from a reservoir in the body.



"Cleco" Rotary Air Grinder

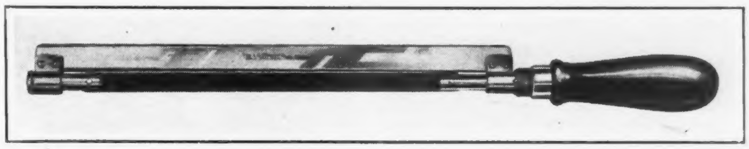
Dustless "Take-About" Sander

A "Take-About" sander with a built-in dust removal system has been added to the line of the Porter-Cable-Hutchinson Corporation, Salina and Wolf Sts., Syracuse, N. Y. In this sander, a double-blade fan, running at 10,000 revolutions per minute, creates a vacuum which draws the dust through ports directly in back of the rear pulley and deposits it in the bag. The dust is easily removed from the bag through the zipper opening. This dust-collecting feature keeps the air clean and prevents excessive clogging of the abrasive belt. The bag is easily removed from the sander.



Motor-driven Sander with Built-in Dust Removal System

A bench stand can be furnished with this device to convert it into an edge sander or grinder. This stand supports the sander in such a way that the belt runs free. When the stand is used, the work is applied to the belt.



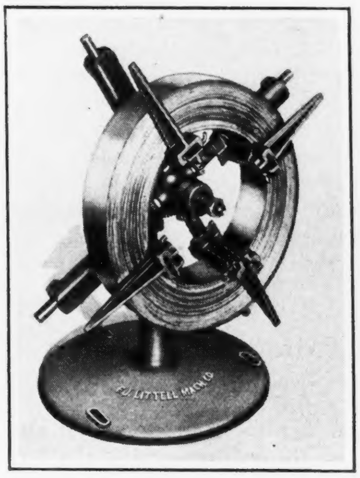
Starrett Hacksaw Frame with Unusually Shallow Throat

Littell Automatic Centering Stock Reel

A ball-bearing stock reel, the arms of which automatically adjust themselves to suit the inside of a coil when the posts are revolved, is a recent development of the F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill.

After a coil has been run off, the operator pushes in a hand-stop to lock the hub. Then, as he revolves the posts toward the right, all four arms move toward the center. This permits the new coil of stock to be slipped over the arms, after which the operator turns the posts toward the left so as to expand the arms against the coil and hold it securely. When the stop has been released, the reel is ready to run again.

The automatic centering feature is advantageous, because stock coils are frequently out of round. Coils weighing up to 500 pounds can be handled, provided the width does not exceed 6 inches, the outside diameter is not more than 40 inches, and the inside diameter is not more than 20 inches nor less than 8 1/2 inches.



Littell Stock Reel with Automatic Centering Arrangement

A double reel of this design is also made, one side of which can be loaded while the other is being used.

Cutler-Hammer Reversing Starter for Small Motors

An across-the-line type of reversing starter for direct- and alternating-current polyphase motors up to 3 horsepower has been added to the line of electrical equipment manufactured by Cutler-Hammer, Inc., 1295 St. Paul Ave., Milwaukee, Wis. This starter is designed for use on small machine tools, hoists, lifts, and other equipment when a half-time intermittent-duty reversing starter is required.

Cutler-Hammer Reversing Starter for Motors up to Three Horsepower

Reversing is accomplished by means of two mechanically interlocked magnetic contactors controlled from a remote point by means of a separate push-button master station. The over-all dimensions of this starter are 7 1/16 inches wide, 8 7/16 inches high, and 4 7/16 inches deep. Two types are made, one of which is arranged for a two-wire control, while the other can be used for either a two- or three-wire remote control.

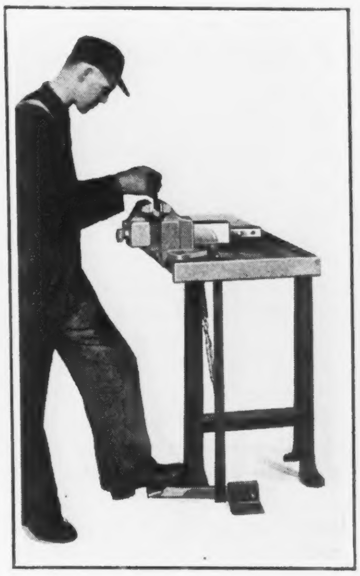
Starrett Hacksaw Frame

A hacksaw frame recently produced by the L. S. Starrett Co., Athol, Mass., has a throat just deep enough to accommodate the blade. With this frame, cuts can be made quickly in spaces where there is hardly more than one inch of clearance. The construction is rigid and makes the frame especially handy for cutting small pipe, conduit, B-X tubing, insulation, etc.

Other advantages claimed for this frame are that it has no tendency to wobble on shallow cuts, that the blade can be strained more with less danger of breakage, and that the saw can be operated with one hand while the other steadies the work.

Simplex Foot-Operated Vise

A production vise operated by means of a foot-treadle instead of by the usual hand-lever is a



Simplex Vise Operated by a Foot-treadle

recent development of the Simplex Tool Co., Woonsocket, R. I. The foot-treadle is depressed to open the moving jaw so that the work can be inserted. When the foot-treadle is released, a 300-pound spring immediately snaps back and pushes two hinged pieces from a V-position, thus furnishing a strong grip. With this arrangement, the operator's hands are always free to handle work or tools.

The vise is set to suit different sizes of work by means of a knurled-head screw that engages a nut in the back jaw. The movable jaw is adjusted by this screw to the approximate thickness of the piece to be held. The foot-treadle is then employed to open the jaws sufficiently to insert the piece. The movement of the jaw by the foot-treadle is about 1/2 inch.

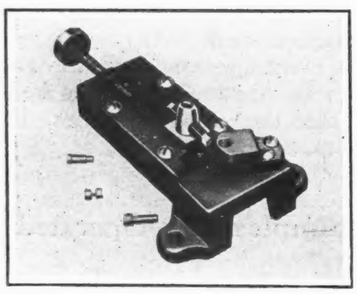


Fig. 1. Urich Flat Type Turning and Forming Attachment

Urich Turning and Forming Attachment

A turning and forming attachment intended to be driven by a bench- or floor-type drilling machine has been placed on the market by the Urich Mfg. Co., Springfield, Ohio. This attachment is made in a flat model, shown in Fig. 1, and in a turret model, illustrated in Fig. 2. In operation, the piece of stock is placed in the drill chuck and the attachment is located with the stock opening directly in line with the machine spindle. The attachment is then clamped in place.

When the drilling machine has been started to revolve the stock, the tool of the attachment is fed toward the stock by means of the handwheel on Model B, Fig. 1,

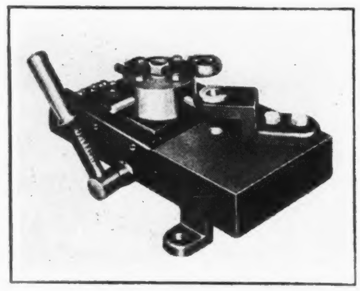


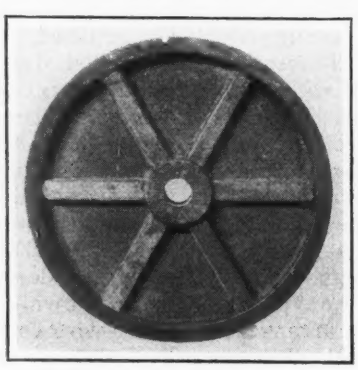
Fig. 2. Turret Type of Attachment for Turning and Forming

and by the lever on Model A, Fig. 2. Stock and slide stops provided on the Model A attachment facilitate the making of duplicate parts by controlling the extreme forward position of the tools. In addition to turning and forming tools, a knurling tool and die-holder may be used on Model A.

Several parts produced with the Model B attachment may be seen adjacent to the attachment in Fig. 1. Much longer pieces than those shown can be produced.

Lukenweld All-Welded Gear Blanks

All-welded rolled-steel blanks for use in the manufacture of cut gears are now made by Lukenweld, Inc., Coatesville, Pa. (a division of the Lukens Steel Co.). These blanks can be employed in the manufacture of spur, herringbone, and helical gears, and can be furnished in any size from 24 inches outside diameter up. The largest of these blanks that has been made had a shipping weight of 4350



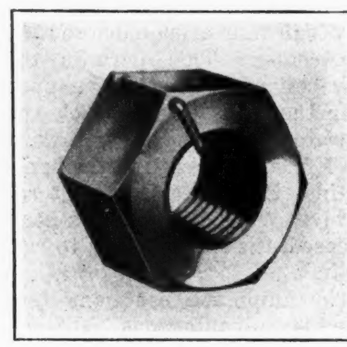
Lukenweld Gear Blank of All-welded Steel Construction

pounds, was 66 3/4 inches outside diameter, and 11 3/4 inches face width. The rim thickness was 4 1/8 inches, and the hub diameter 22 1/2 inches.

While these all-welded gear blanks are ordinarily made entirely from S.A.E. 1020 carbon steel, the rims can be furnished in special steels.

Automatic Lock-Nut

A nut that is self-locking at any point along a bolt is being introduced on the market by the General Automatic Lock Nut Corporation, General Motors Bldg., New York City. As will be seen from the illustration, this nut is provided with a locking pin that follows around the bolt thread when the nut is

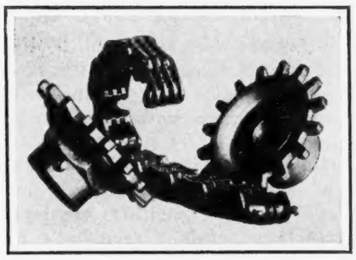


Lock-nut that is Self-locking at Any Point Along a Bolt

tightened against the work. The pressure exerted by the thread against the pin turns the pin at an angle in such a way that the end in engagement with the thread effectively prevents the nut from being loosened by vibration or shock. However, the nut can be removed easily with a wrench. It may be put on and taken off repeatedly without damage to the pin or to the thread of either the bolt or nut.

"Midget" Chain and Sprocket Coupling

A flexible coupling applicable to small horsepower installations has been placed on the market by the Morse Chain Co., Division of the Borg-Warner Corporation,

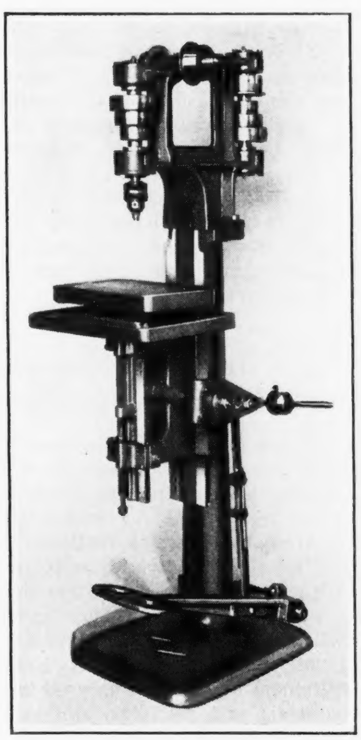


Morse Flexible Coupling for Small-horsepower Drives

Ithaca, N. Y. This coupling, known as the "Midget," is a miniature counterpart of the chain-and-sprocket coupling made by the concern for installations up to 5000 horsepower. It consists of two sprockets wrapped by a chain, and is designed for application to shafts up to 1 inch in diameter.

Frew Drilling Machine with Feeding Table

The vertical drilling machine here illustrated, which has been brought out by the Frew Machine Co., 132 W. Venango St., Philadelphia, Pa., differs from the majority of machines of this kind on the market in that the work is moved to and from the drill instead of the spindle being moved to and from the work. This is done by raising and lowering the table through the foot-treadle or by means of a hand-lever, which can be provided instead. The table unit is balanced to give the operator the right "feel."



Frew Drilling Machine Arranged for Feeding the Work to the Drill

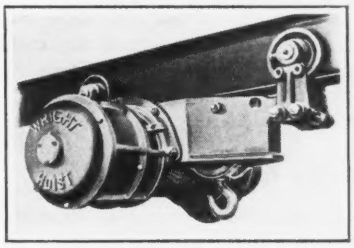
This machine is adapted for accurate jig drilling and similar work. Mounted on a dovetailed way on the column is a knee which can be raised or lowered and locked in position to obtain the major adjustment between the spindle and the table. The knee carries a gear that meshes with a rack fitted in the table slide. The slide is furnished with a stop-screw which can be set for the desired length of stroke. The raising and lowering mechanism is adjustable so that the height of the foot-treadle can be set to suit the operator. Ball bearings are provided for the spindle and back-shaft.

A direct motor drive can be supplied, in which case the motor is mounted on the head unit in place of the back-shaft, and the three-step cone is mounted on the motor shaft. The machine has a capacity for drilling holes up to 1/2 inch. It weighs approximately 680 pounds.

Wright Electric Hoist

A Type WH electric hoist, designed for installations having minimum head-room, has been placed on the market by the Wright Mfg. Co., Bridgeport, Conn. The minimum distance from the bottom of the I-beam to the hook is 11 inches on the 1/2-ton size, and 13 inches on the 1-ton size. The design is such that the hoist drum and sheaves are of ample size to prevent excessive cable wear.

This hoist includes the features of the standard electric hoists made by the concern. Either a push-button or pendant-rope control is optional. "Tru-Lay Preformed" cable is used. The equipment includes a safety-type limit switch, safety-type load block, and positive mechanical brake. Oil-bath lubrication is provided.

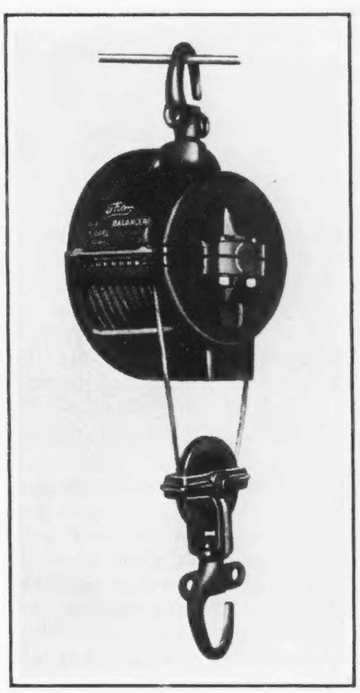


Wright Electric Hoist for Minimum Head-room Installations

Thor Balancer for Portable Tools

A balancing device designed for suspending portable electric and pneumatic tools from the ceiling over the work is shown in the accompanying illustration. This Thor balancer is a recent product of the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill.

The cable drum is of a tapered construction, which makes it possible for a spring to maintain a constant holding effect regard-



Device for Holding Portable Tools at Any Height over the Work

less of the position of the load. For instance, when the load is at the highest point and the cable is fully wound on the drum, the last layer of cable exerts force or torque against the spring through the shortest radius of the drum. When the load is lowered, the cable unwinds to a larger radius of the drum, so that while the tension on the spring increases with the lowering of the load, the "torque arm" or drum radius also increases. The load may be moved to any position without effort.

This balancer is made in three sizes—the No. 1 has a capacity of 30 pounds; the No. 2, 60 pounds; and the No. 3, 80 pounds.

News of the Industry

George A. Orrok, David Moffat Myers, and W. A. Shoudy, consulting engineers, announce the removal of their offices to 21 E. 40th St., New York City.

Service Machine Co., Inc., gave a reception to the employes and their families in the company's new building, recently completed at 750-760 Broadway, Elizabeth, N. J., on Monday, May 25.

General Engineering & Mfg. Co., 1519 S. 10th St., St. Louis, Mo., has purchased the shaper manufacturing business of the R. A. Kelly Co., Xenia, Ohio. These shapers have been manufactured by the R. A. Kelly Co. since 1895.

Young Radiator Co., Racine, Wis., has appointed W. H. Benduhn representative on the Pacific Coast for the sale of the radiators, cooling systems, and heating units made by this company. Mr. Benduhn will be located at 664 Mission St., San Francisco, Calif.

White Sewing Machine Corporation, Cleveland, Ohio, has just closed a contract with Electrolux, Inc., 250 Park Ave., New York City, for the manufacture of the Electrolux vacuum cleaner. These Electrolux cleaners are now being manufactured in Stockholm, Sweden.

Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturer of conveyors and screening machinery, has moved its Chicago office to larger quarters in the Civic Opera Building at 20 N. Wacker Drive. C. H. Adamson, secretary of the firm, will be in direct charge of sales and engineering for the Chicago territory.

Roller-Smith Co., 233 Broadway, New York City, has appointed the Commercial Engineering Co., 1800 E St., N.W., Washington, D. C., sales agent in the District of Columbia. The Commercial Engineering Co. will handle the entire Roller-Smith line of electrical measuring instruments, air and oil circuit breakers, relays, and control panels.

Dardelet Threadlock Corporation, 120 Broadway, New York City, has granted the S. M. Jones Co., of Toledo, Ohio, a license to manufacture and sell sucker rods with the Dardelet self-locking screw thread. The company has also granted licenses to the Colorado Fuel & Iron Co. for the manufacture and sale of track and commercial bolts and nuts formed with the Dardelet self-locking thread.

Cutler-Hammer, Inc., 1295 St. Paul Ave., Milwaukee, Wis., manufacturer of electric control apparatus, at the last annual meeting held in April, elected Frank R. Bacon, former chairman of the board, president of the company to fill the vacancy caused by the death of Beverly L. Worden. The other officers elected were as follows: Vice-presidents, F. L. Pierce and J. C. Wilson; treasurer, H. F. Vogt; and secretary, W. C. Stevens.

Stacey Engineering Co., and the International Derrick & Equipment Co., through the action of their stockholders, have been merged to form the International-Stacey Corporation, with headquarters at Columbus, Ohio. Colonel C. A. Thompson of Cleveland, Ohio, former president of the Stacey Engineering Co., will be chairman of the board of directors. Harry M. Runkle, former president of the International Derrick & Equipment Co., will be president and general manager.

Ramet Corporation of America, North Chicago, Ill., has been formed to take over the United States and Canadian rights in Ramet hard cutting metal developed by the Fansteel Products Co., Inc., of North Chicago, Ill. This corporation is a subsidiary of and owned by the Fansteel Products Co., Inc. The officers of the Ramet Corporation of America are J. M. Troxel, president; C. E. Stryker, vice-president and general manager; and E. F. Radke, secretary and treasurer.

Kearney & Trecker Corporation, Milwaukee, Wis., announces that the company has produced a moving-picture reel entitled "Milling with Tungsten Carbide." Engineering societies, executive and foremen groups, and other organizations who may be interested can obtain the film for use at meetings by applying to the corporation. The film is available in either 16- or 35-millimeter size. It illustrates the application of tungsten-carbide milling cutters, and gives speeds, feeds, and cutting time.

Korfund Co., Inc., manufacturer of Korfund natural cork plate, Vibro-Damper, and other materials for the isolation of machinery vibration, has moved into a new plant at 48-15 Thirty-second Place, Long Island City, N. Y. The company now has available a great deal of additional manufacturing floor space and considerably enlarged offices. Much new manufacturing machinery will be installed. The company reports an increasing volume of business, largely due to recognition of the need for adequate isolation of vibration and noise in machinery installations.

Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., has taken over the exclusive selling rights in the United States for the Firth Hardometer, made by Thos. Firth & John Brown, Ltd., Sheffield, England. The Firth Hardometer is a new hardness testing machine employing the Brinell principle of pressing a steel ball or diamond indenter by means of a known load into the specimen to be tested. The hardness is determined by measuring the width of the impression with an illuminated microscope which is built into the machine.

Manning, Maxwell & Moore, Inc., 100 E. 42nd St., New York City, announces that the company has withdrawn from direct sales representation of the Putnam machine tools and the Shaw overhead electric traveling cranes in the Chicago territory. Dean Machinery Co., 80 E. Jackson Blvd., Chicago, has been appointed to represent Manning, Maxwell & Moore, Inc., in the sale of Putnam machine tools and Shaw cranes in the Chicago territory. The Chicago office of the Consolidated Ashcroft Hancock Co., Inc., a subsidiary of Manning, Maxwell & Moore, Inc., will continue to operate without change.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces that at an organization meeting of the board of directors, the following officials were elected: A. W. Robertson, chairman of the board; F. A. Merrick, president; J. S. Tritle, vice-president in charge of manufacturing; S. M. Kintner, vice-president in charge of engineering; W. S. Rugg, vice-president in charge of sales. L. A. Osborne, H. P. Davis, H. D. Shute, J. S. Bennett, H. T. Herr, Walter Cary, T. P. Gaylord, and Harold Smith were re-elected vice-presidents. C. H. Terry was elected an honorary vice-president, and E. M. Herr was re-elected vice-chairman.

Exhibit of Materials Testing Equipment

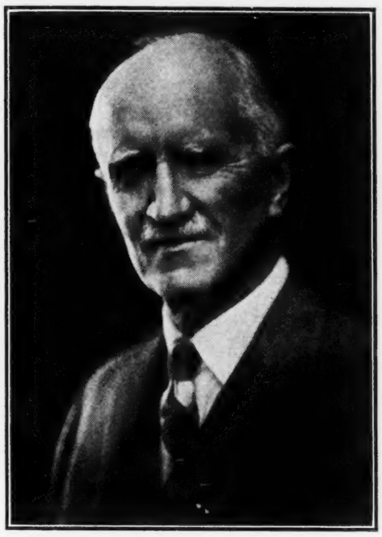
For the first time in the history of the American Society for Testing Materials, an exhibit of testing apparatus and machines will be held in conjunction with the annual meeting of the Society, which will take place at the Stevens Hotel in Chicago, June 22 to 26. The exhibit has been arranged with a view to creating a distinctly scientific and broadly educational atmosphere. It is limited to equipment and apparatus used in testing materials and products, and to recording and control equipment used in testing laboratories. The exhibit will afford those attending the annual meeting of the Society an opportunity to acquire first-hand knowledge of available equipment, especially of the newer developments.

Obituaries

James N. Heald

James N. Heald, president and general manager of the Heald Machine Co., Worcester, Mass., died at his home, 25 Randolph Road, Worcester, on May 6. Mr. Heald had been in poor health for several years and for the last few months his condition had been serious. His death was due to heart trouble.

Mr. Heald was born in Barre, Mass., September 21, 1864. His early education was obtained in the grammar and high schools of Barre, after which he attended the Worcester Polytechnic Institute, graduating with the degree of Bachelor of Science in the class of 1884. Immediately upon graduation, he entered the business owned by his family at Barre.



James N. Heald

The history of this business has few counterparts in the United States for unbroken ownership and management in a single family, four generations having participated in running it. The concern was established in 1826, one hundred and five years ago, by Stephen Heald. The little shop started at that time did machine jobbing and later produced agricultural and wire-drawing machinery. Stephen Heald's son, Leander, the father of James N. Heald, was taken into the business, and the partnership of S. Heald & Son was formed. Later, when James N. Heald joined the business, both his grandfather and father were still running it. Stephen Heald died in 1888, and the firm then became L. S. Heald & Son, James N. Heald taking over the management. It was then that the real growth of the business began.

In 1903, James N. Heald bought out his father's interest and organized the Heald Machine Co., which was transferred to Worcester. The original shop was only 90 by 100 feet. This has grown to a factory 300 by 600 feet, which in busy times employs 800 men.

At the time of his death, Mr. Heald was president and general manager of the company, but had turned over many of the duties of management to his sons, of whom there are four: Roger N., Richard A., Robert S., and Stanley W. Heald. Roger N. Heald is vice-president and works manager, and Richard A. Heald is secretary and treasurer.

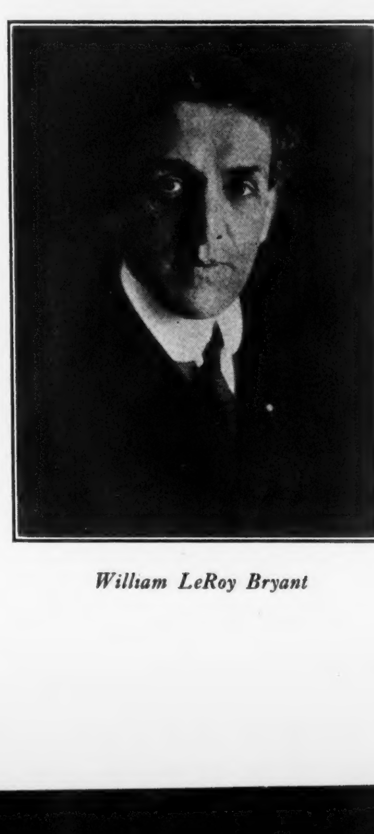
Mr. Heald was well known throughout the entire machinery industry. For many years he was a member of the National Machine Tool Builders' Association, serving as its treasurer and also for three years as a member of the board of directors. He was also a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers, as well as of many local clubs and associations. He is survived by his wife and four sons.

William LeRoy Bryant

William LeRoy Bryant, president of the Bryant Chucking Grinder Co., Springfield, Vt., died suddenly April 25, at the age of fifty-six. Mr. Bryant was well known in machine tool manufacturing circles, and to users of grinding equipment he has long been identified as the inventor of the Bryant chucking grinder.

Mr. Bryant was born in Northfield, Vt., in 1875. He obtained his education at the Black River Academy, Ludlow, Vt., and at the University of Vermont, from which he graduated in 1898 with the degree of Bachelor of Science. After graduation, he became associated with the Jones & Lamson Machine Co., Springfield, Vt., ultimately becoming chief engineer of the company. In 1909 he left the Jones & Lamson company to form the Bryant Chucking Grinder Co.

Mr. Bryant's contributions to the development of machine tool design and machine shop practice in the last thirty years have been outstanding. He was a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers, and a director of the Associated Industries of Vermont. He was also a director of the First National Bank of Springfield, Vt. Mr. Bryant is survived by his widow, Mrs. Blanche Brown Bryant, and two sons, William J. and Allen L. Bryant.



William LeRoy Bryant

William A. Long

William A. Long, affectionately known as Billy to men everywhere in the manufacturing industries, died on May 3 at the age of sixty years. For the last thirty-six years Mr. Long had devoted his time and energy to the cutting and finishing of gears. In this connection, he had traveled all over the country, and was widely known. During these years he worked for the Brown & Sharpe Mfg. Co., the Barber-Colman Co., the Pierce Arrow Motor Car Co., the Franklin Motor Car Co., and the Pratt & Whitney Co., with which latter company he was associated at the time of his death. His passing will be regretted by many close friends in the automotive industry.

William A. Long

F. A. Estep, former chairman of the board of directors of the R. D. Nuttall Co., Pittsburgh, Pa., died April 12 in St. Petersburg, Fla., at the age of eighty-two. Mr. Estep was born in Old Allegheny, Pa., and attended the public schools and the Western University of Pennsylvania, now the University of Pittsburgh. In May, 1893, Mr. Estep was elected president and treasurer of the R. D. Nuttall Co., which offices he held until 1925, when he was elected chairman of the board of directors, retaining this position until he retired in 1928. During the time that Mr. Estep served as the head of the R. D. Nuttall Co., that company became a leader in the development and manufacture of gear products for street railway, mining, and industrial service. Mr. Estep was a member of the American Electric Railway Association and of the American Gear Manufacturers Association. He is survived by his wife, a son, and a daughter.

CHARLES W. GREENING, secretary and treasurer of the Toledo Machine & Tool Co., Toledo, Ohio, died April 29, following a lingering illness. Mr. Greening had been identified with the company for over thirty years, having been engaged as bookkeeper in 1901. Later he was given charge of purchases, in addition to his other duties. In 1910, when Graff M. Acklin, then secretary and treasurer of the company, sold out his interests, Mr. Greening was appointed secretary and treasurer to fill this vacancy, and continued to serve the company in this capacity until his death. Mr. Greening had a wide acquaintance in the machine tool industry throughout the country, and will be missed by a host of friends.

FRANK V. KEIP, well known to the readers of MACHINERY as a contributor of many articles on tool design and shop practice, died at his home in Adrian, Mich., March 14, at the age of fifty-three years. He was ill only one week. Mr. Keip was born in Adrian in 1877, and was employed by the American Electric Fuse Co. in that city as a machinist in 1900, rapidly advancing to foreman. Later he became connected with the Page Woven Wire Fence Co. as a diemaker, and since 1914 he has been in the employ of the Schwarze Electric Co., of Adrian, as mechanical engineer. He is survived by his widow, Edith Myrtella (Harkness) Keip, and one son, Victor, a student in the law department of the University of Michigan.

Personals

H. W. CLOUGH has been made sales manager of the Belden Mfg. Co., 4647 W. Van Buren St., Chicago, Ill., manufacturer of electrical accessories.

WALTER C. SHUNK has been appointed mining engineer of the Goodman Mfg. Co., 4834 S. Halsted St., Chicago, Ill. Mr. Shunk succeeds the late Sidney W. Farnham.

J. P. HILANDS, for many years eastern sales representative of the Ohio Seamless Tube Co., Shelby, Ohio, has severed his connections with that company. W. S. THOMPSON, who has been identified with the New York office of the company, will succeed Mr. Hilands.

JOHN M. LESSELLS, formerly manager of the Mechanics Division of the Westinghouse Research Laboratories, has been appointed manager of engineering in the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., to succeed A. D. HUNT, who has resigned.

G. H. GARCELON has been appointed manager of the control engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Garcelon succeeds J. H. BELKNAP, who has been transferred to the engineering division of the Pittsburgh district office.

S. M. KINTNER, assistant vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was elected vice-president in charge of engineering at a recent meeting of the board of directors, succeeding W. S. RUGG, who has been elected vice-president in charge of sales.

C. H. ADAMSON has been appointed Chicago district manager of the Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturer of conveyors and screening machinery. Mr. Adamson, who is secretary of the company, was director of the company's advertising and sales promotional work for many years.

J. H. MORRIS was elected secretary of the Inland Steel Co., First National Bank Bldg., Chicago, Ill., at a recent meeting of the board of directors. Mr. Morris succeeds W. D. TRUESDALE, formerly secretary and treasurer. Mr. Truesdale will continue to hold the position of treasurer. All of the officers of the company were re-elected.

R. H. BACON, formerly advertising manager of Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill., has been made manager of the pump sales division, with headquarters in Chicago. Mr. Bacon has been associated with the company since 1925.

R. H. Bacon

GARRET A. CONNORS has been appointed vice-president and director of purchases of the Truscon Steel Co., Youngstown, Ohio. Mr. Connors has served as an executive in the production division of the company for the last twenty-four years. In his new capacity, he will have complete charge of the purchases for all the Truscon plants. His headquarters will be at Youngstown.

WILLIAM L. HARTLEY has been made district sales manager of the Link-Belt Co., Chicago, Ill., in charge of the Detroit territory. Mr. Hartley has been in the employ of the Link-Belt Co. since 1915, having started in the engineering department. Since 1928 he has been in charge of the foundry sales division of the company. His headquarters will be at 5938 Linsdale Ave., Detroit.

C. G. WENNERSTROM, chief engineer of Foote Bros. Gear & Machine Co., Chicago, Ill., for the last six years, has joined the Universal Gear Corporation, 327 S. LaSalle St., Chicago, Ill. Mr. Wennerstrom will assist in the development of the Universal line of power transmission equipment and in its adaptation to all classes of industry where speed reduction equipment is required.

J. MORRIS IRELAND, for five years manager of the Cleveland office of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed special representative for the company. He will devote his efforts to industrial electrification. F. G. HICKLING, formerly transportation manager of the Westinghouse central district organization, will succeed Mr. Ireland as Cleveland manager of the Westinghouse sales organization. He will make his headquarters at the sales offices, 2209 Ashland Road, Cleveland.

GEORGE H. CORLISS, 771 Hancock St., Wollaston, Mass., who for the last fifteen years has been advertising and office manager of the S. A. Woods Machine Co., Boston, Mass., has left this company. He has not yet announced his plans for the future. Mr. Corliss has had a broad experience in advertising, as well as in domestic and foreign sales promotion; in addition to his duties with the S. A. Woods Machine Co., he has handled the publicity for the Association of Manufacturers of Woodworking Machinery.

EDWARD C. BULLARD was given a testimonial dinner at the Hotel Stratfield, Bridgeport, Conn., on the evening of May 7, to mark the occasion of his appointment as general manager of the Bullard Co., to succeed his uncle, the late Stanley Hale Bullard. Edward C. Bullard was also elected a vice-president of the company recently. A feature of the dinner was a special honor table at which were seated the "old timers" of the Bullard organization. This group consisted of twenty-three men whose service with the Bullard Co. averaged thirty-two years each.

RALPH STEWART MACPHERRAN, chief chemist of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., was awarded the Whiting gold medal of the American Foundrymen's Association at the annual meeting of the Association in Chicago, in recognition of his many valuable contributions to the gray iron castings industry. Since the establishment of the medal in 1920, it has only been awarded twice previously. Mr. MacPherran has been identified with the iron and steel industry for nearly forty years. He graduated from the University of Michigan in 1892 with the degree of B.S. in chemistry. In 1895, he came to the E. P. Allis Co., later the Allis-Chalmers Mfg. Co., and has been with this company ever since, except for one year.

Prepare Your Toolroom Now for increasing business

———with new

Brown & Sharpe Grinding Machines

First to feel the demands of new production ahead . . . first in determining the value of the tools that have such an influence on the cost and quality of your product . . . the toolroom deserves the first consideration. Meet improving business with better toolroom equipment and gain an immediate and lasting effect in lowering manufacturing costs.

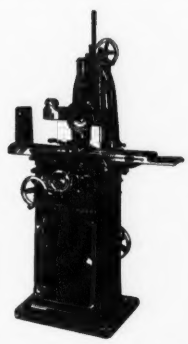
Practically any type of grinding that is required in the toolroom can be done accurately and economically on Brown & Sharpe Grinding Machines. They are exceptionally easy to set up. They save nonproductive time, both of man and machine, a most important factor in lowering toolroom costs.

Prepare first in the toolroom . . . for replacement and for additional equipment select Brown & Sharpe Grinding Machines. Send for specifications.

BROWN & SHARPE

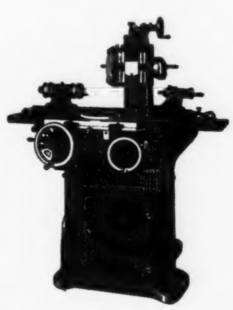
BROWN & SHARPE MFG., CO. PROVIDENCE, R. I., U. S. A.

No. 2 Surface



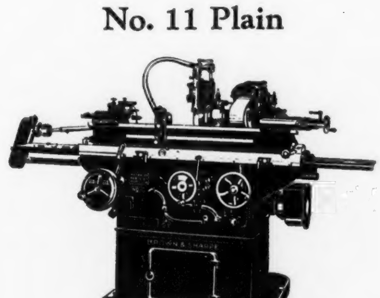
Fast, accurate, easy to operate—the ideal toolroom surface grinding machine—the No. 2 can be readily and quickly adapted to a large variety of work.

No. 13 Universal and Tool



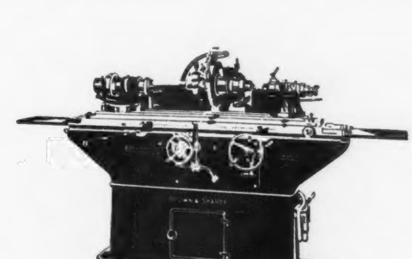
The No. 13 Universal and Tool Grinding Machine — a high-grade, general purpose toolroom machine. Particularly useful for sharpening milling cutters of all kinds and for grinding small cylindrical work.

No. 11 Plain



Ordinarily regarded as a production machine, the versatility of the No. 11 permits its profitable use for toolroom work such as boring bars, reamers, plug gauges, etc.

Nos. 1, 2, 3 and 4 Universal



Particularly adapted for toolroom use, the Nos. 1, 2, 3 and 4 Universal Grinding Machines, because of their ease of set-up and their inherent accuracy, make most profitable units.

Coming Events

JUNE 1-3—Regional meeting of the American Society of Mechanical Engineers at Hartford, Conn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 12-13—Eighth annual convention of the National Association of Foremen at the Biltmore Hotel, Dayton, Ohio. E. H. Tingley, secretary, Refiners Bldg., Dayton, Ohio.

JUNE 15-19—Summer meeting of the Society of Automotive Engineers at White Sulphur Springs, W. Va. John A. C. Warner, secretary, 29 W. 39th St., New York City.

JUNE 22-26—Annual meeting of the American Society for Testing Materials at the Stevens Hotel, Chicago, Ill. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

AUGUST 23-29—International Industrial Relations Congress to be held at Amsterdam, Holland. Further information may be obtained from Mary van Kleeck, Russell Sage Foundation Bldg., New York City.

SEPTEMBER 21-25—Annual meeting of the American Society for Steel Treating and National Metal Exposition to be held at the Commonwealth Pier, Boston, Mass. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 13-16—Twenty-fifth annual convention of the Illuminating Engineering Society at the William Penn Hotel, Pittsburgh, Pa. For further information, apply to the secretary, Illuminating Engineering Society, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 4—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies' Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 5—First National Exposition of Mechanical Handling Equipment to be held at the Grand Central Palace, New York City. Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York City.

Societies, Schools and Colleges

DREXEL INSTITUTE, Philadelphia, Pa. Catalogue for 1931-1932, containing calendar and outline of courses.

TEMPLE UNIVERSITY, Philadelphia, Pa. Annual catalogue (1931) containing calendar, outline of courses, and other information pertaining to the University.

POLYTECHNIC INSTITUTE OF BROOKLYN, 99 Livingston St., Brooklyn, N. Y. Bulletin of graduate courses (day and evening) in engineering, chemistry, physics, and mathematics.

New Catalogues and Circulars

STEEL. Inland Steel Co., First National Bank Bldg., Chicago, Ill. Booklet entitled "Sizes We Roll and Standard Extras."

OIL-LEVEL GAGES. Pioneer Instrument Co., 754 Lexington Ave., Brooklyn, N. Y. Circular descriptive of the Pioneer oil-level gage for aircraft and marine use.

FLEXIBLE COUPLINGS. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. Bulletin 240, illustrating and describing the Crocker-Wheeler new resilient flexible coupling.

GENERATORS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Circular 1908, containing information on Westinghouse small generator units and their application.

PYROMETER TUBES. Claud S. Gordon Co., 708 W. Madison St., Chicago, Ill. Circular containing price lists of the various sizes of X-ray inspected metal pyrometer tubes.

HYDRAULIC PUMPS. Viking Pump Co., Cedar Falls, Iowa. Bulletin descriptive of Viking hydraulic pumps for pressures up to 500 pounds. Charts showing representative performance data are included.

GRAY IRON CASTINGS. Gray Iron Institute, Inc., Terminal Tower Bldg., Cleveland, Ohio. Folder entitled "Standard Sales Agreement and Trade Customs in the Gray Iron Foundry Industry."

LUBRICATING EQUIPMENT. Gits Bros. Mfg. Co., 1846-62 S. Kilbourn Ave., Chicago, Ill. Catalogue 31, containing dimensions and other data on oil-cups and automatic multiple oilers and oil seals.

TRANSMISSION EQUIPMENT. T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin 369, containing dimensions and list prices of Wood-Fafnir ball-bearing hanger boxes, hanger frames, and pillow blocks.

BEARING METALS. Sumet Corporation, 1543 Fillmore Ave., Buffalo, N. Y. Circular describing the physical characteristics and applications of Sumet bearing bronze, which is made in eight standard grades for various uses.

CHUCKS. Skinner Chuck Co., New Britain, Conn. Circular illustrating and describing briefly Skinner four-jaw independent lathe chucks. Tables of dimensions and prices are included for chucks made with iron and with steel bodies.

CUTTERS. O. K. Tool Co., Inc., Shelton, Conn. Pamphlet entitled "Cutting Costs with Cutting Tools," containing a brief outline of the development of O. K. cutting tools, together with information on the design and construction of these tools.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating applications of the Cleveland overhead tramrail system in the automotive industry.

NICKEL ALLOYS. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin 208 in a series on Data and Applications of Nickel Cast Iron. This bulletin treats of "Ni-Resist"—a corrosion- and heat-resistant nickel-copper-chromium cast iron.

TOOL GRINDERS. Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. Circular 1041, entitled "Are Poorly Ground Tools Increasing Your Costs?" calling attention to the importance of correctly ground tools and the advantages of the Gisholt tool grinder.

DIESEL ENGINES. Ingersoll-Rand Co., 11 Broadway, New York City. Bulletin treating of Ingersoll-Rand solid-injection Diesel engines. The advantages of Diesel power are discussed, and a general description of I-R Diesel engines ranging from 150 to 1200 horsepower is given.

ALLOY STEEL CASTINGS. Duriron Co., Inc., Dayton, Ohio. Bulletin containing information on Durimet and Durco Nirosta—alloy steels developed by this company to resist corrosive conditions. A table showing the resistance of these alloys to various chemicals is included.

VENTILATING AND COOLING EQUIPMENT. Coppus Engineering Corporation, Worcester, Mass. Bulletin 160-3, descriptive of the line of fans, blowers, exhausters, etc., made by this concern. A table of characteristics and performance of Coppus "heat killers" is included.

JIG BORING MACHINES. Keller Mechanical Engineering Corporation, 74 Washington St., Brooklyn, N. Y. Booklet describing the construction and operation of the Kellocater jig boring machine for precision boring and laying out. Complete specifications of the machine are included.

SCREWS. Bristol Co., Waterbury, Conn. Catalogue 825, containing descriptive material, illustrations, and price lists of the Bristo line of safety set-screws and cap-screws. Various applications of these screws are illustrated, and tables of American standard screw threads are included.

BABBITT. Buffalo Foundry & Machine Co., 1635 Fillmore Ave., Buffalo, N. Y. Bulletin containing information on a new babbitt metal produced by the "Thermo-lectric" process. This metal is made in two grades—nickel babbitt and copper-hardened babbitt for different requirements.

MACHINE TOOLS AND SMALL TOOLS. Rivett Lathe & Grinder Corporation, Brighton District, Boston, Mass. Bulletins 100-A, 104-B, and 507-B, illustrating and describing, respectively, draw-in collets and chucks, internal-external precision grinders, and plain precision bench lathes.

PULLEYS AND DRIVES. American Pulley Co., Philadelphia, Pa. Bulletin containing list prices of American Wedgbelt pulleys and drives. The tables contain, in addition to prices, simplified data for designing and ordering. Eight different center distances are given for each standard ratio.

GAGE PROTECTORS. Champion & Barber, Inc., 576 Subway Terminal Bldg., Los Angeles, Calif. Bulletin illustrating and describing the Champion gage protector and the non-pulsator, two units which are designed to protect fluid gages from solid substances, injurious fluids, and from the effects of pulsation.

STEEL STORAGE EQUIPMENT FOR SCHOOLS. Durabilt Steel Locker Co., Aurora, Ill. Bulletin entitled "Steel Storage Equipment for the Modern School Shop," containing an article that appeared in Bruce's *School Shop Annual*. The bulletin describes the steel storage cabinets made by this concern.

COPPER AND BRASS PRODUCTS. American Brass Co., 25 Broadway, New York City, is planning to distribute from time to time a bulletin entitled "News About Anaconda Metals." The first issue, which appeared early in April, dealt primarily with one of the company's special alloys known as "Everdur."

ENGINEERING METALS. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin entitled "Engineering Metals for the Process Industries," containing a reprint of an article, "The Design and Construction of Heavy Equipment in Monel and Pure Nickel," from *Chemical and Metallurgical Engineering*.

SHEET-METAL WORKING TOOLS AND MACHINES. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 75, descriptive of Niagara rotary machines and tools for sheet-metal working. Capacity, dimensions and other data for the various types of machines are given in tabulated form.

GRINDERS AND MILLING MACHINES. Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., Cincinnati, Ohio. Booklet entitled "High Lights of Manufacturing," containing a description of some of the operations and tests performed by these companies in order to insure high quality in their products.

STRUCTURAL STEEL SECTIONS. Carnegie Steel Co., Pittsburgh, Pa. Pocket Companion (abridged edition), listing the revised series of CB structural steel sections. In addition to the data on the CB series, information is given covering the more commonly rolled sections used

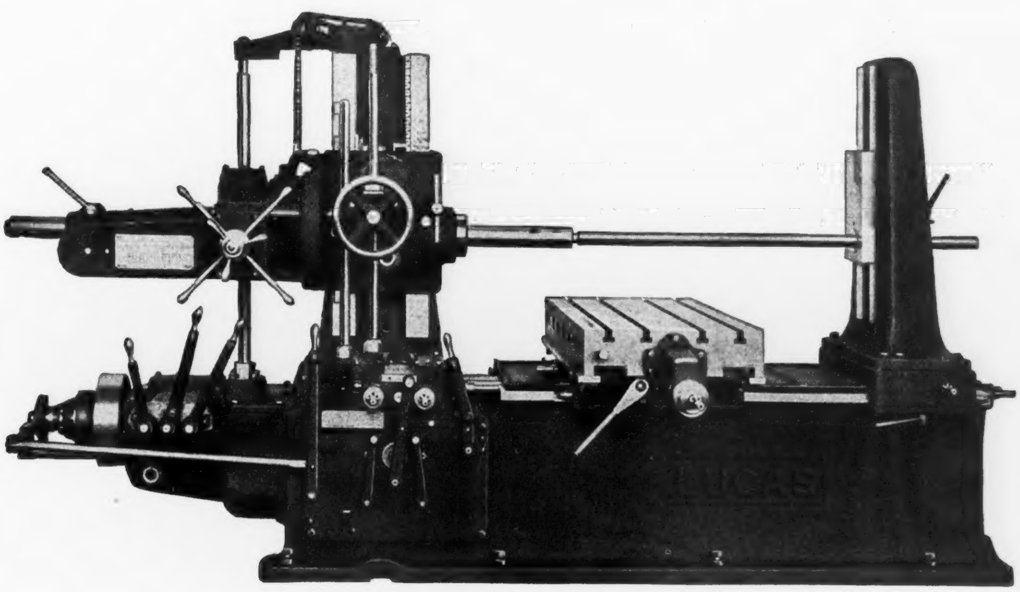
Is antique collecting your hobby?

It's expensive enough at home, but we can't afford it in our machine shops where antiques are decidedly out of place. For, obsolete machine tool equipment is an almost insurmountable handicap in competing with shops having modern tools—especially if they include the

Latest Type LUCAS

"Precision" Horizontal Boring, Drilling and Milling Machine

Write NOW for descriptive circular.



This up-to-date machine will turn out MUCH MORE and BETTER WORK, made possible by many improvements in design and materials which have become available only recently.

All in all, the Lucas "Precision," with its wide range of capabilities, its quick, accurate performance, is a profitable investment for any shop.

Let one of our representatives go over your work and our machine in detail. When may he call?

THE LUCAS MACHINE TOOL COMPANY, Cleveland, O.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. Andrews & George Co., Tokyo. Catmur Machine Tool Corp., Ltd., London, Eng. M. Kocian & G. Nedela, Prague. V. Lowener, Copenhagen, Oslo, Stockholm. Emanuele Mascherpa, Milan, Italy. R. S. Stokvis & Zonen, Rotterdam, Paris.

in structural design, as well as in car- and ship-building.

LATHE DRIVES. Rivett Lathe & Grinder Corporation, Brighton District, Boston, Mass. Bulletin 120-A, illustrating a complete line of mounting and driving equipment for bench lathes, including speed-box motor drive, direct motor drive, horizontal safety drive countershafts, and ball-bearing countershafts and jackshafts.

SPEED REDUCERS. Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill. Catalogue 301, illustrating and describing, in detail, the construction of HyGrade worm-gear speed reducers. Complete information, including ratios, ratings, graphs, engineering data, and dimensions of all types and sizes of the new line, is given.

ELECTRIC HOISTS. Wright Mfg. Co., Bridgeport, Conn. Catalogue, containing forty-eight pages, completely describing the Wright line of electric hoists. Dimensions and other useful data are given. The hoists shown include hook and bolt suspension types, plain, geared, and motor-driven trolley hoists, and drum and low head-room types.

MACHINE TOOLS. American Tool Works Co., Cincinnati, Ohio. Circular illustrating typical machines made by this company, including lathes, radial drilling machines, and shapers. An interesting feature of the bulletin is the graphic comparison shown of actual work results obtained with machines built in 1921 and those built today.

INDICATING AND CONTROLLING EQUIPMENT. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Circular illustrating and describing a new indicating control instrument for automatically controlling relatively high-temperature processes and units, such as heat-treating furnaces, enameling furnaces, galvanizing tanks, etc.

FASTENING DEVICES. Parker-Kalon Corporation, 200 Varick St., New York City. Booklet entitled "Why Self-tapping Screws Make Stronger as well as Cheaper Fastenings." The booklet outlines the results of comparative tests made with self-tapping screws and other screws. Charts of comparative tension and shear strength are also included.

AIR COMPRESSORS. Davey Compressor Co., Inc., Kent, Ohio. Bulletin entitled "Four Air Compressors Went to School," containing the results of a test made on Davey air-cooled air compressors by the Professor and Associate Professor of Mechanical Engineering at the Case School of Applied Science. The test was of 500 hours' duration without a stop.

PUMPS. Brown & Sharpe Mfg. Co., Providence, R. I. Circular listing the complete line of pumps made by this company, including gear, vane, and centrifugal types. These pumps are adapted for hydraulically operated machines, for supplying liquids under pressure, for circulation, for furnishing coolants to machine tools, etc. In addition to the pump listings, engineering data is given.

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Bulletins 910, 1042-G, 1062, 1088, and 1105, dealing, respectively, with EC & M separator magnets; 110-550-volt automatic compensators; magnetic contactors for alternating-current motors; motor field rheostats and relays; and EC & M push-buttons. New price lists applying to these bulletins have also been issued.

STANDARDIZED, INTERCHANGEABLE DIE SETS. Danly Machine Specialties, Inc., 2104-2130 S. 52nd Ave., Chicago, Ill. Seventh edition of a loose-leaf catalogue showing the complete line of standardized interchangeable die sets and diemakers' supplies made by this concern. One of the illustrations shows the largest die set and die space that can be used on all standard makes and sizes of presses.

POWER TRANSMISSION EQUIPMENT. Link-Belt Co., 300 W. Pershing Road, Chicago, Ill. Booklet 1293, entitled "A Saving at Every Turn," descriptive of seven types of positive drives for the transmission of power, including silent chain drives, roller chain drives, herringbone gears, herringbone speed reducers, steel and malleable chains, worm-gear speed reducers, and the P.I.V. gear (variable-speed transmission).

RECORDING AND INDICATING INSTRUMENTS. Wilson-Maeulen Co., Inc., 382 Concord Ave., New York City. Bulletins illustrating and describing the improved Tapalog pyrometer recorder, which is operated entirely by electric power. Standard scale ranges, prices, and other data relating to the various models are given. Circular descriptive of a recording electric thermometer equipped with resistance bulbs.

BALL BEARINGS. S K F Industries, Inc., 40 E. 34th St., New York City. Bulletin 203, dealing with preloaded ball bearings for precision spindles. The bulletin contains information on methods of loading ball bearings; characteristics and design of S K F preloaded ball bearings; analysis of deflections and stresses; advantages of S K F preloaded bearings; lubrication, protection, and enclosure; and typical mounting designs.

TURRET LATHES. Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. Bulletins Nos. 2A, 64, 65, 66 and 67, illustrating and describing, respectively, Gisholt Nos. 4 and 5 turret lathes; turret lathe production of flywheels; machining a long shaft by the use of special tooling; three operations performed in 5¾ minutes; and remarkable saving in time effected in turning 700-pound crankshafts on a double side carriage Gisholt heavy-duty turret lathe with extended bed.

MOTORIZED COUNTERSHAFTS AND SPEED REDUCERS. Production Equipment Co., 5219 Windsor Ave., Cleveland, Ohio. Circular illustrating and describing the motorized countershafts and speed reducers made by this concern. The countershafts are made in two styles, one having a box type base and the other an overhung type of base. The motorized speed reducers consist of a standard semi-enclosed motor integrally mounted with a speed reduction unit and are manufactured in three types.

GEAR-TOOTH LAPPING AND TESTING MACHINES. National Broach & Machine Co., Shoemaker and St. Jean Sts., Detroit, Mich. Circulars describing a "Red Ring" gear-tooth lapping machine and a "Red Ring" universal gear tester. The circular dealing with the lapping machine mentions that the process followed is new and that it involves the use of a lap, the axis of which is not parallel with the axis of the gear. The circular pertaining to the gear tester explains the methods followed in checking spur and helical gears.

CHUCKS. Jacobs Mfg. Co., Hartford, Conn. Publication entitled "The Jacobs Spindle Book," containing complete information on the spindle specifications of practically all drilling machines, portable tools, tapping machines, lathes, screw machines, centering machines, and special-purpose tools in which chucks with taper shanks are used. The book also contains illustrations and descriptions of Jacobs chucks of different models. The information relating to the spindles on machines and equipment should be of great value to the industry at large.

STANDARDIZED PUNCHES AND DIES. Allied Products Corporation (Richard Bros. Division), 1560-74 Milwaukee Ave., Detroit, Mich. Catalogue listing the complete line of standardized interchangeable piercing punches and dies, die sections, die sets, guide pins, bushings, springs, spring pilots, dowels, screws, and stripper bolts made by this concern. All these products are carried in stock at the various warehouses of the company. Ordering instructions and an index chart showing punches, dies, backing plates, dowels and screws, and their relationship to retainer numbers are included.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for April 1, 1931.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Estate of Alexander Luchars; Louis Pelletier; and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 18th day of March, 1931.

CHARLES P. ABEL,

Notary Public, Kings County No. 228
(SEAL) Kings Register No. 1038
New York County No. 35, New York Register No. 1-A-25
(My commission expires March 30, 1931)

WETMORE

ADJUSTABLE REAMERS

In every industry there is one product that is held up as the standard — specified by buyers who want to be sure of having "the best". The makers of Wetmore Reamers, through many years of exacting work, have placed the name "Wetmore" in this position. Today, the leading motor manufacturers specify "Wetmore" for reamers they *know* will give them the utmost in precision, finish, convenience of use, and long life. Send for latest catalog of all types of Wetmore Adjustable Machine and Cylinder Reamers.

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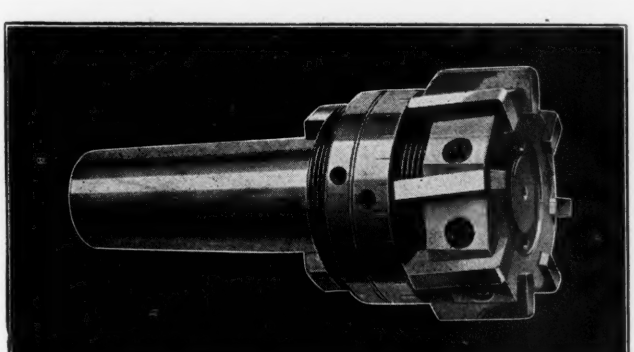

WETMORE ADJUSTABLE CYLINDER REAMERS

The Roughing Reamer, with right-hand angle blades, is sturdily designed to withstand initial operation. Removes unusually large amount of stock. The Semi-finishing Reamer has left-hand angle blades which eliminate "digging in" and chatter. The Finishing Reamer, with left-hand angle blades and float-in-head design, gives a reaming action obtained by no other tool.

Classified Contents of this Number

New Developments in Electric Welding

Do you think of electric butt-welding mainly as a means of joining comparatively small pieces? If so, you will be surprised to learn from an article in July MACHINERY, that joints having a cross-section up to 18 square inches are now being butt-welded. The enormous pressure of 100,000 pounds forces the electrically heated faces of the joints together suddenly.

Your Progress Depends Upon Your Knowledge of Your Industry